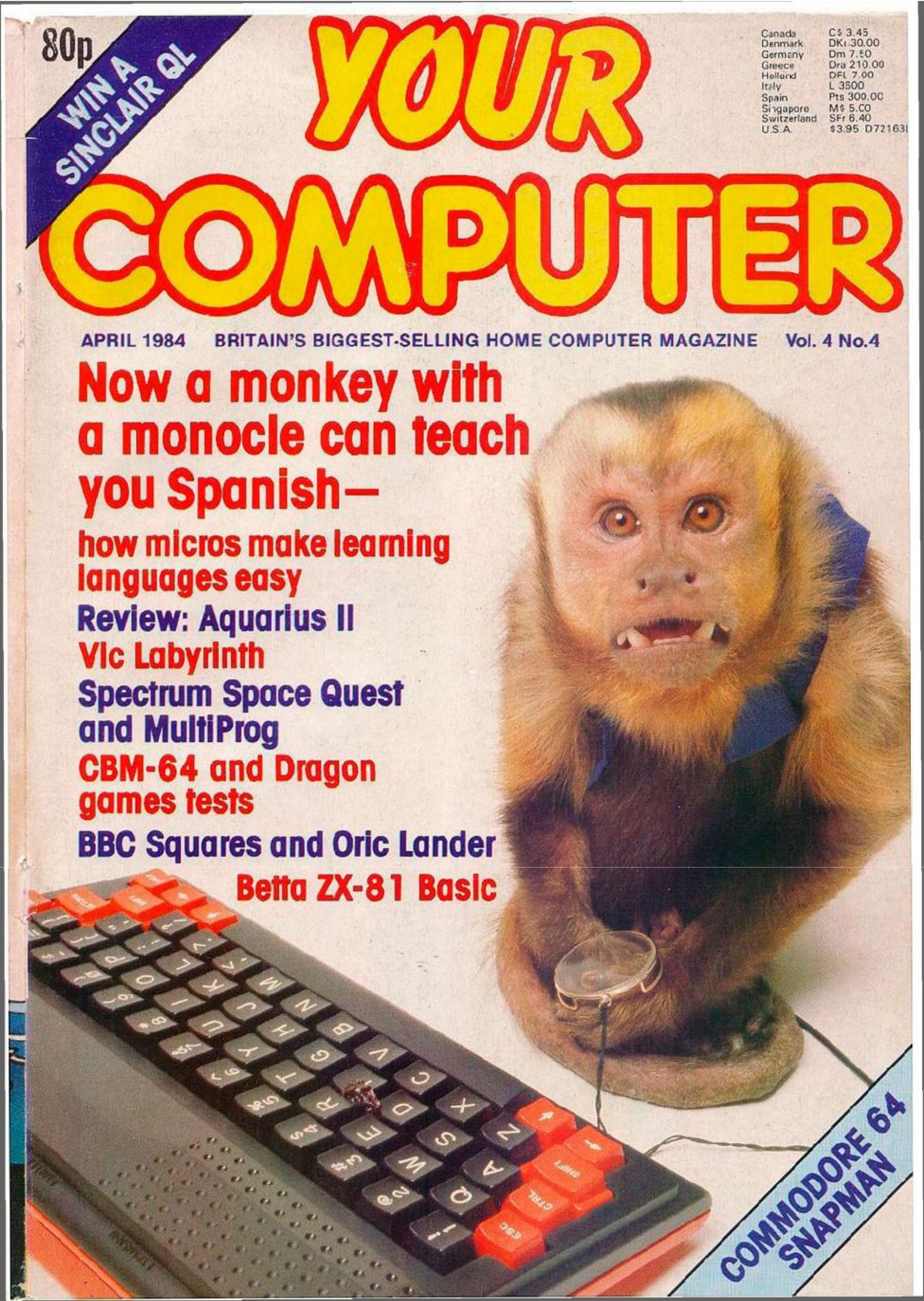
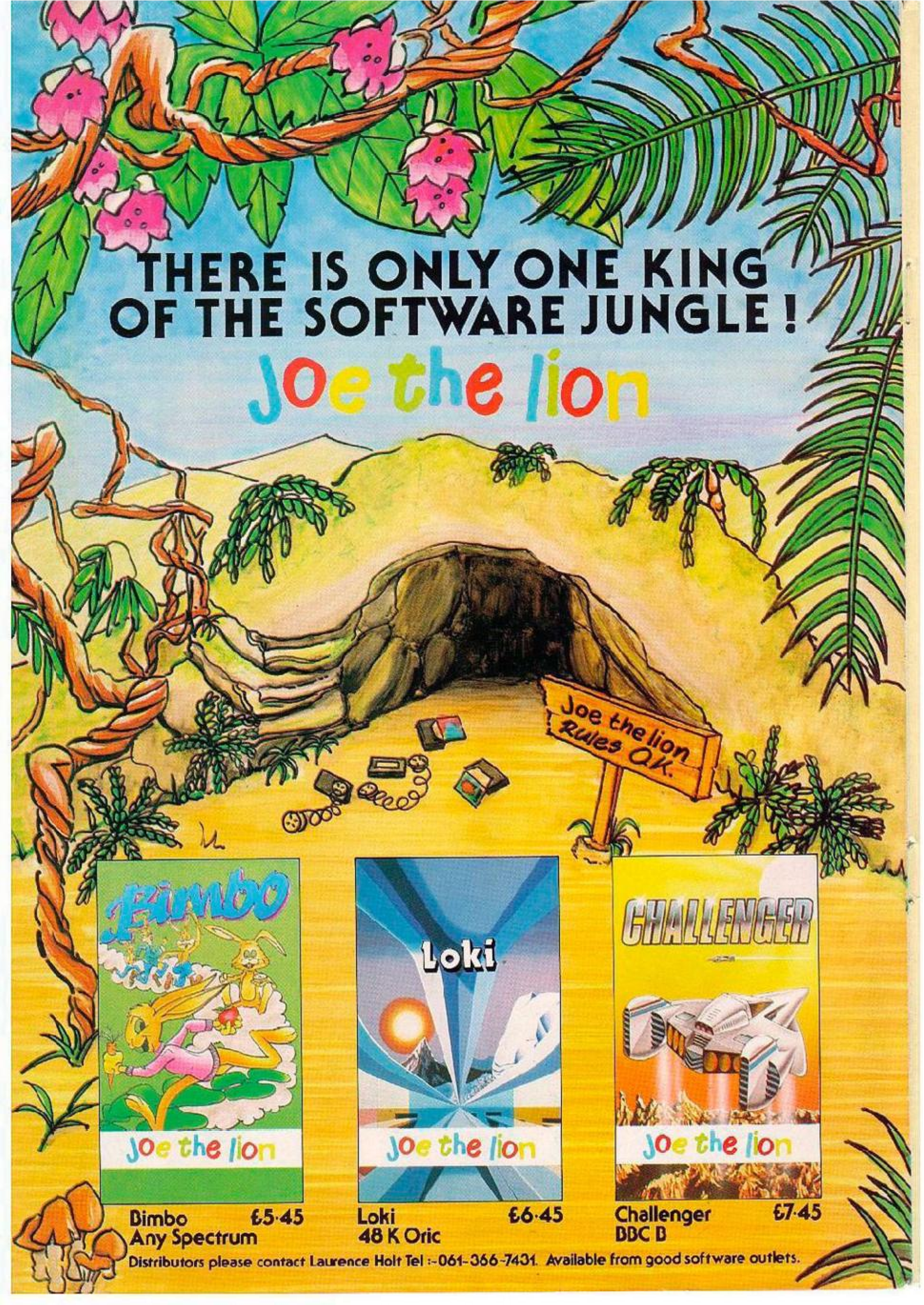
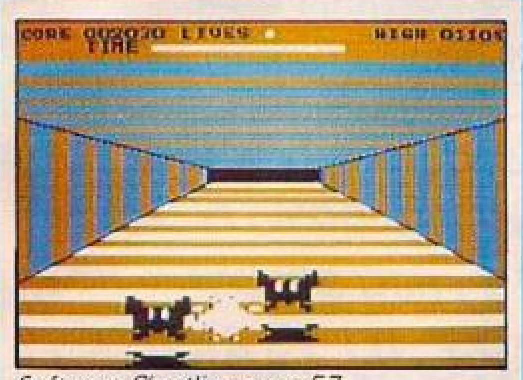

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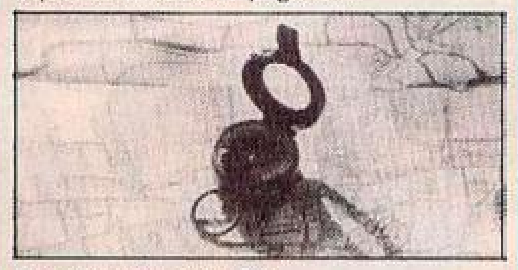
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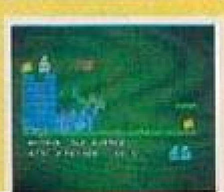
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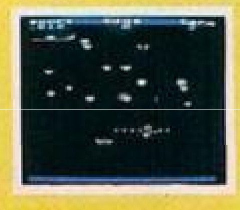

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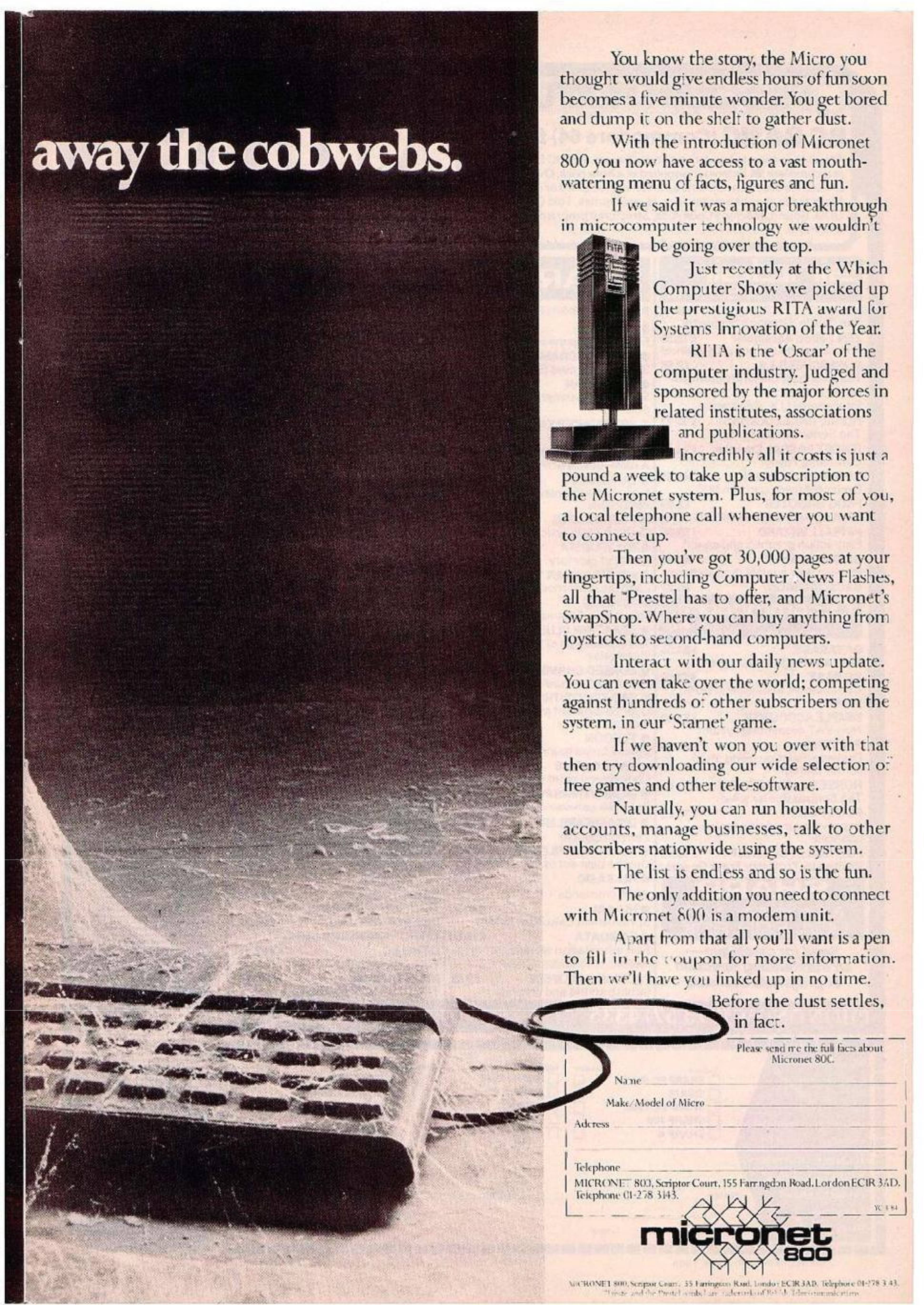
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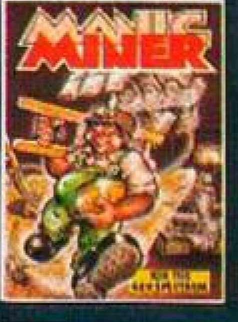


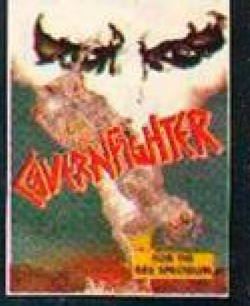
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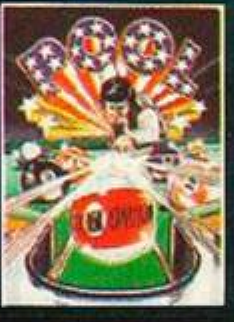
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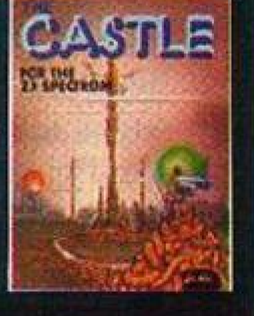
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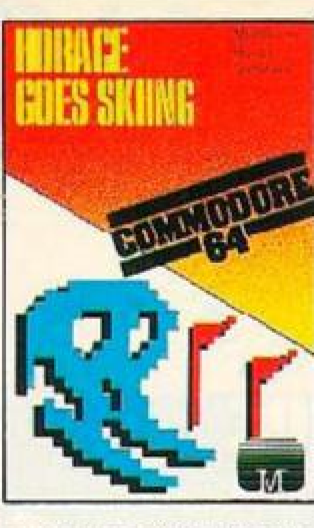
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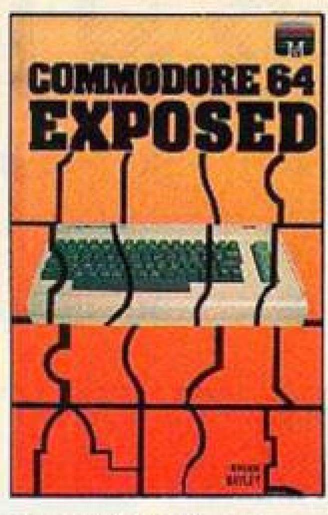
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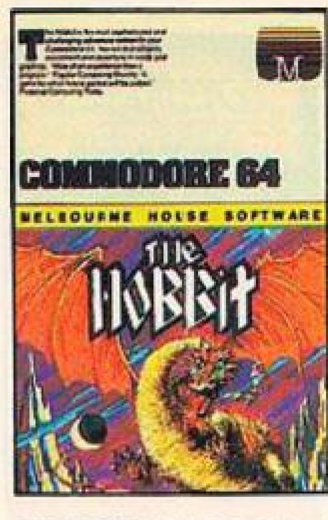
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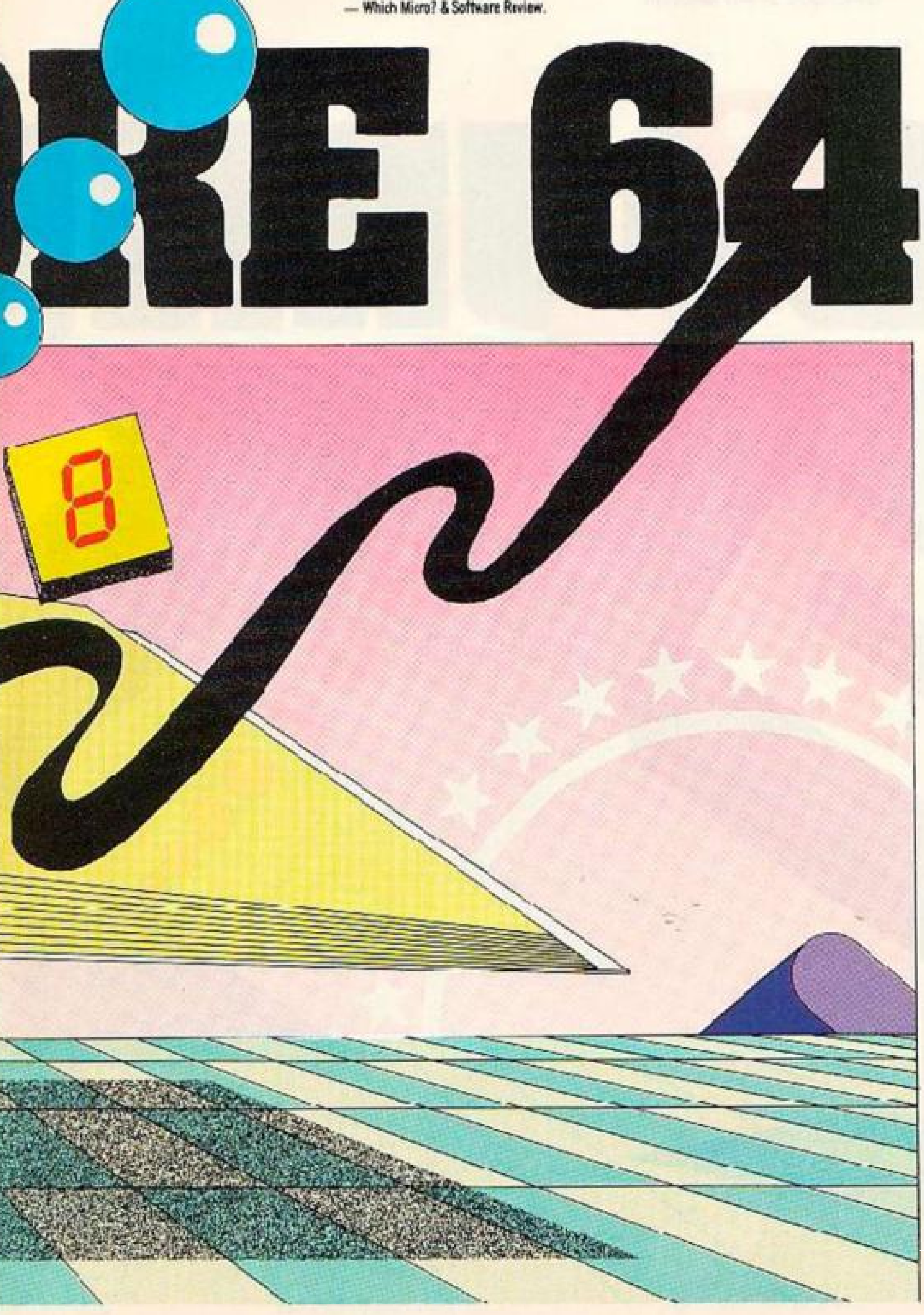




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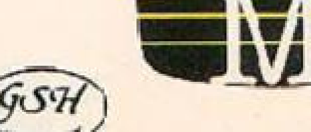
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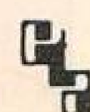
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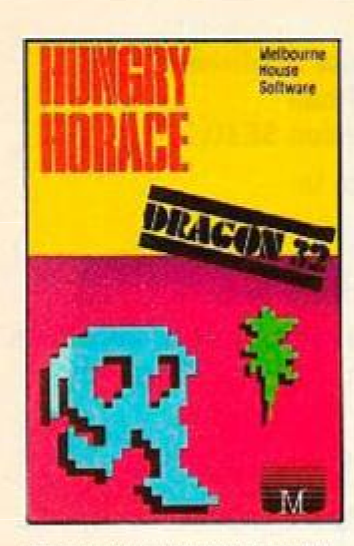


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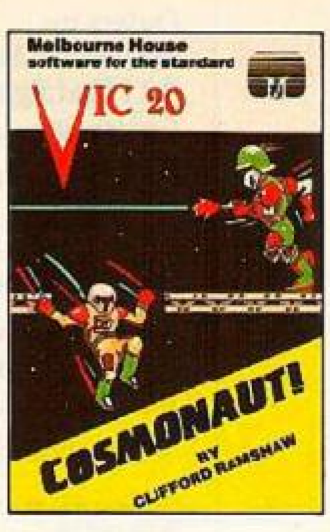








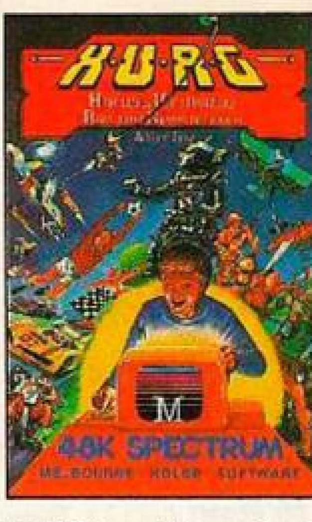
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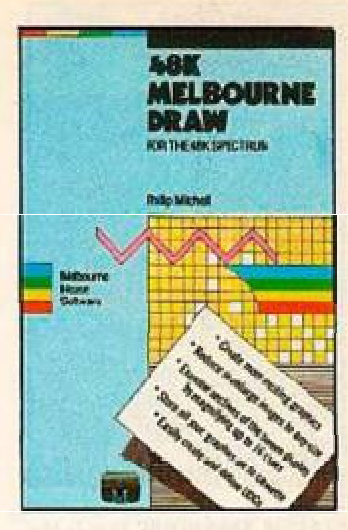
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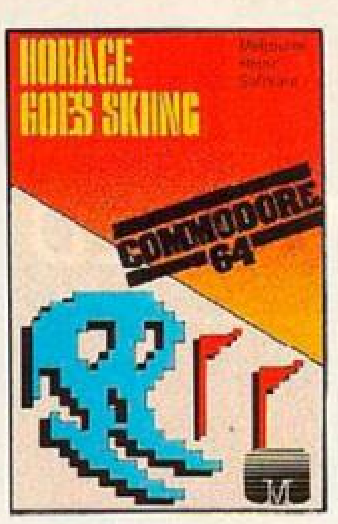
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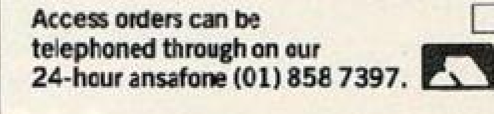
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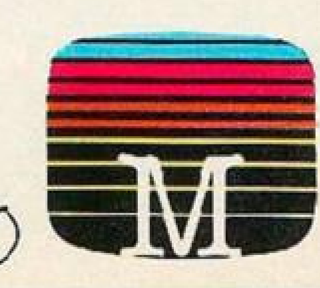
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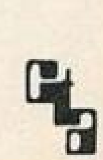
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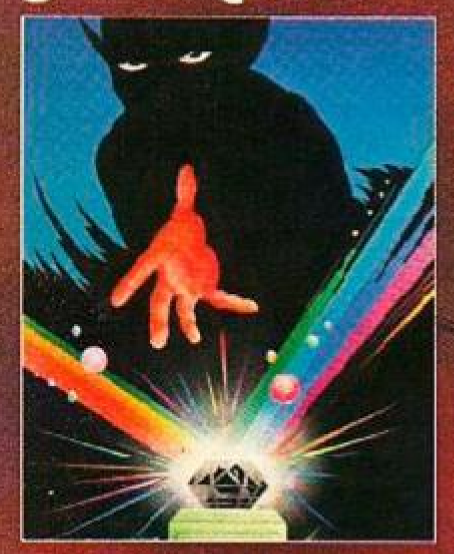






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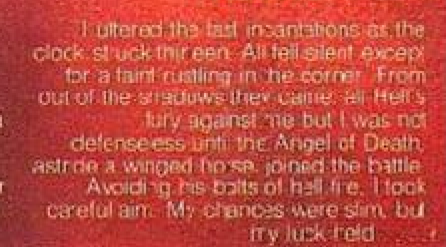
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THE DEVIL RIDES IN

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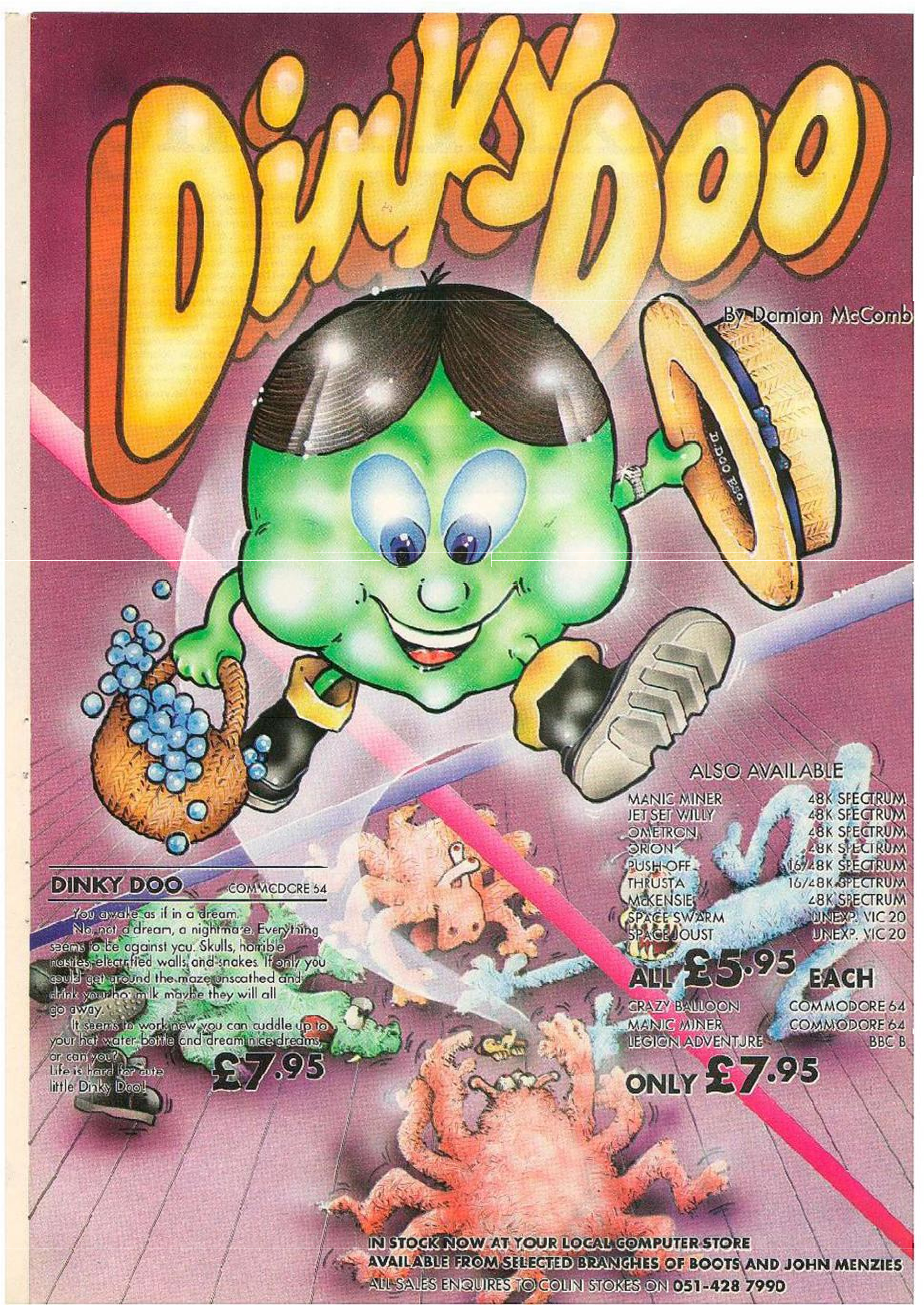
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technology

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In the UK there has been such rapid development in microsystems that in many cases users have been seduced by the technology rather than the standards they should be following. In educational and business applications the need for continuity is obvious. This is accentuated by the development of database technology, where very large information files are accumulated, the primary expense being the input of data.

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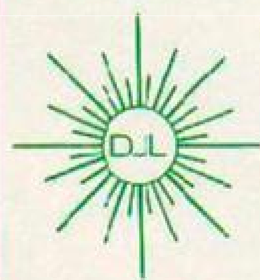


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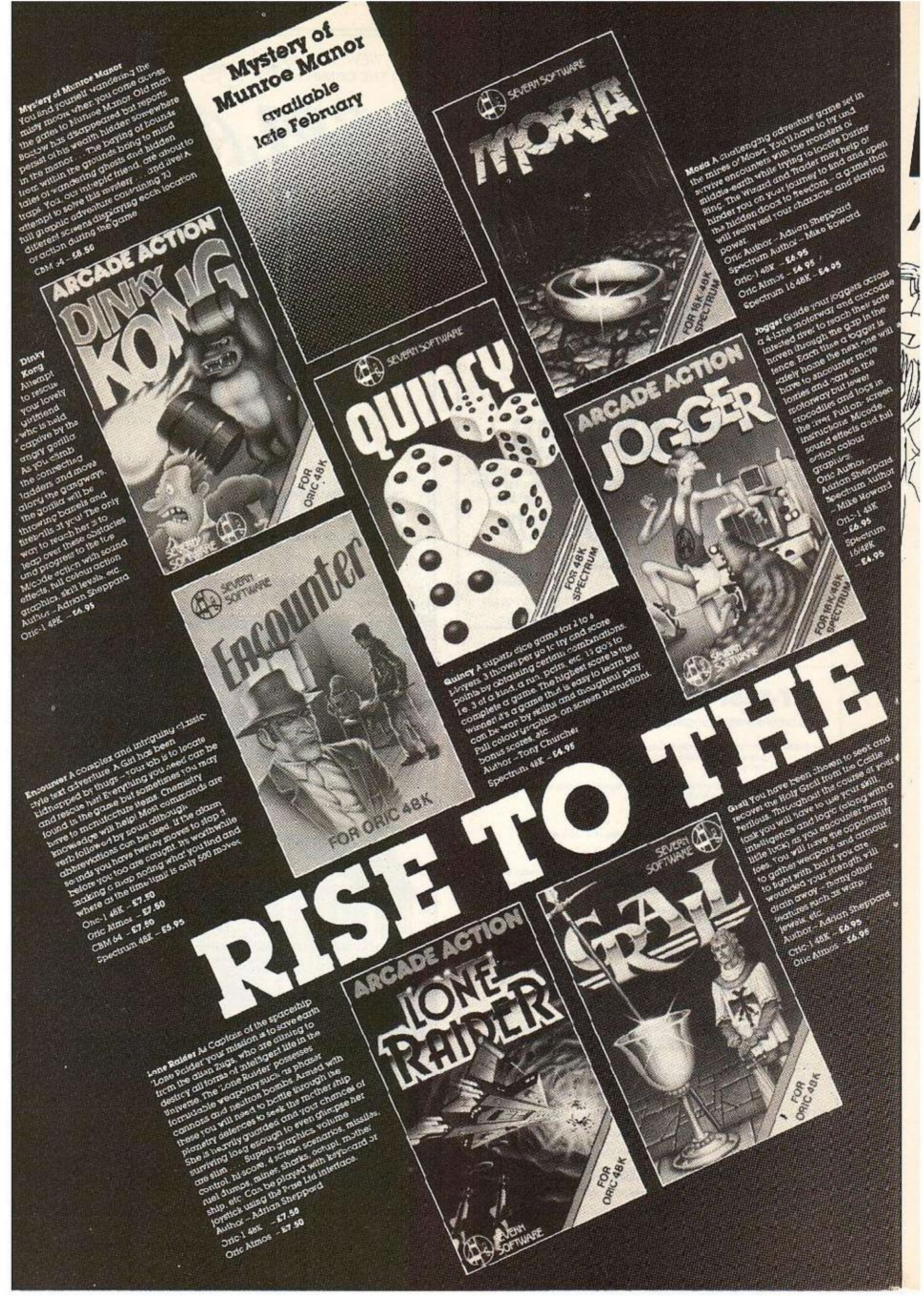
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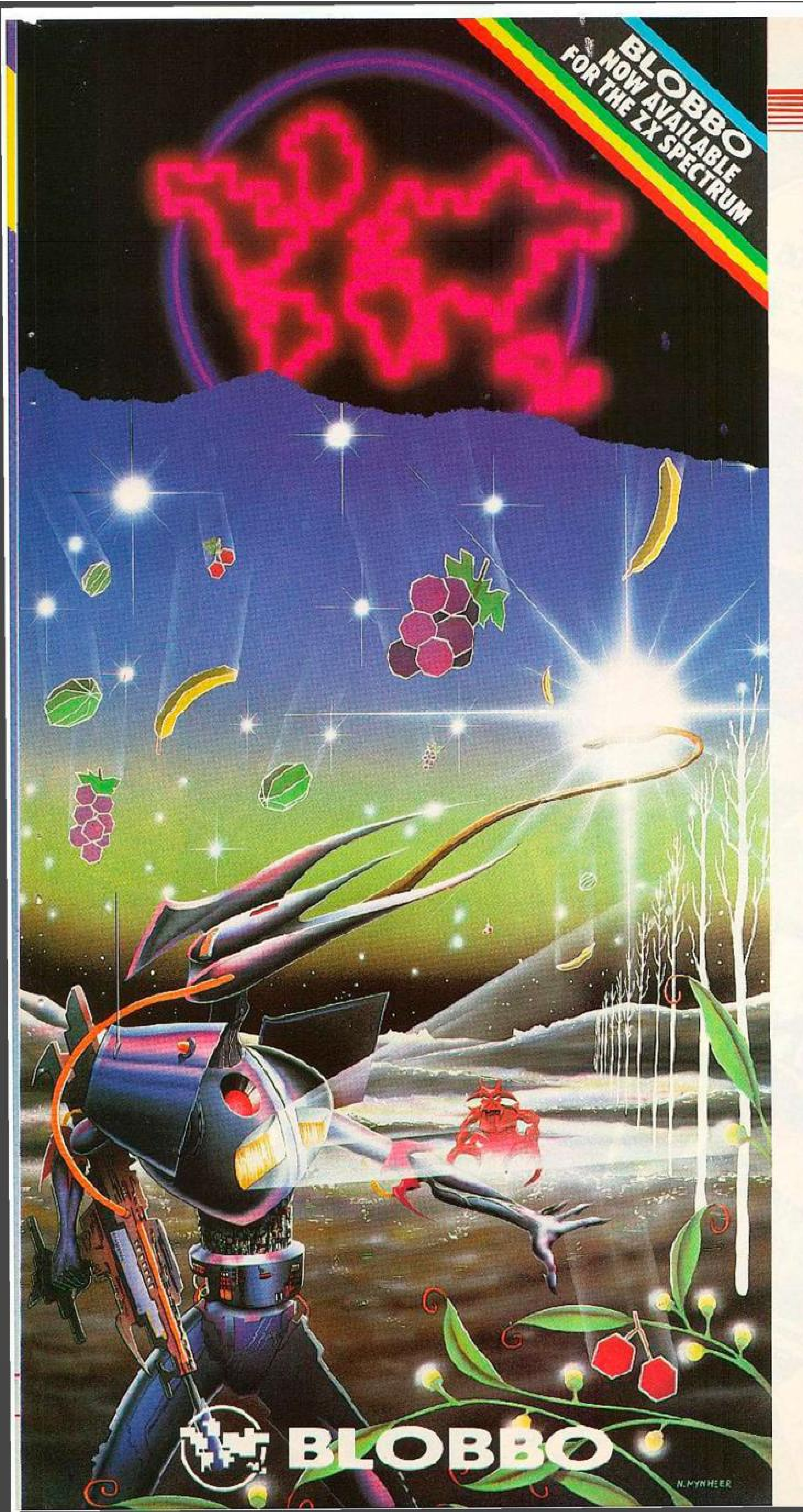
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Silica Shop Ltd.
1-4 The Mews, Hatherley Road, Sidcup, Kent DA14 4DX. (01) 301 1111 or (01) 309 1111.
Ace Software
94 Western Road, Southall, Middx UB2 5DZ. (01) 574 4098.
Rams Computer Centre
117 Queensway, Bletchley, Bucks. (0908) 647744.
Gatwick Computer Services
62 The Boulevard, Crawley, W. Sussex. (0293) 26240.
Landau Electronics (Sutton) Ltd.
215 High Street, Sutton, Surrey. (0164) 35494.
Vision Store
96-98 Northend, Croydon, Surrey CR0 1UD. (01) 631-7539.
Computasolve
8 St Marks Hill, Surbiton, Surrey. (01) 390 5135.
3D Computers
230 Tolworth Rise South, Tolworth, Surbiton, Surrey KT5 9NB. (01) 337 4317.
Video City
45-47 Fishers Green Road, Stevenage, Herts. (0438) 53808.
Datastore
Victoria Road, Hailsham, Sussex. (0328) 846777.
Modata Computers Ltd
30 St Johns Road, Tonbridge Wells, Kent. (0892) 41555.
The Advanced Technology Centre
207 Eltham High Street, Eltham, London. (01) 859 7696.
Adams World of Software
190c Station Road, Edgware, Middlesex. 01-952 0451.

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Photosave
18 Cheapside, Bradford BD1 4JA. (0274) 308598.
Bass + Bligh
4 Lower Briggate, Leeds. (0532) 454451.
The Computer Show
Unit 25 Handyside Arcade, Percy Street, Newcastle-upon-Tyne. (0632) 616260.
York Computer Centre
7 Stonegate Arcade, York. (0904) 641862.
Small Fry + Hobby
51-53 Kirkgate, Wakefield WF1 1HX. (0924) 360551.
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Home Computers
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Chester Software Centre
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Channel 8 Software
51 Fishergate, Preston. (0772) 53057.
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Wildings Computer Centre
11 Mesnes Street, Wigan. (0942) 44382.
Micro Workshop
273 Moston Lane, Moston, Manchester. (061) 205 4974.
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Livingston Computer Centre,
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Clywd Personal Computers
Unit 19, Daniel Owen Precinct, Mold. (0352) 56842.
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St Georges Crescent, Wrexham. (0978) 264451.

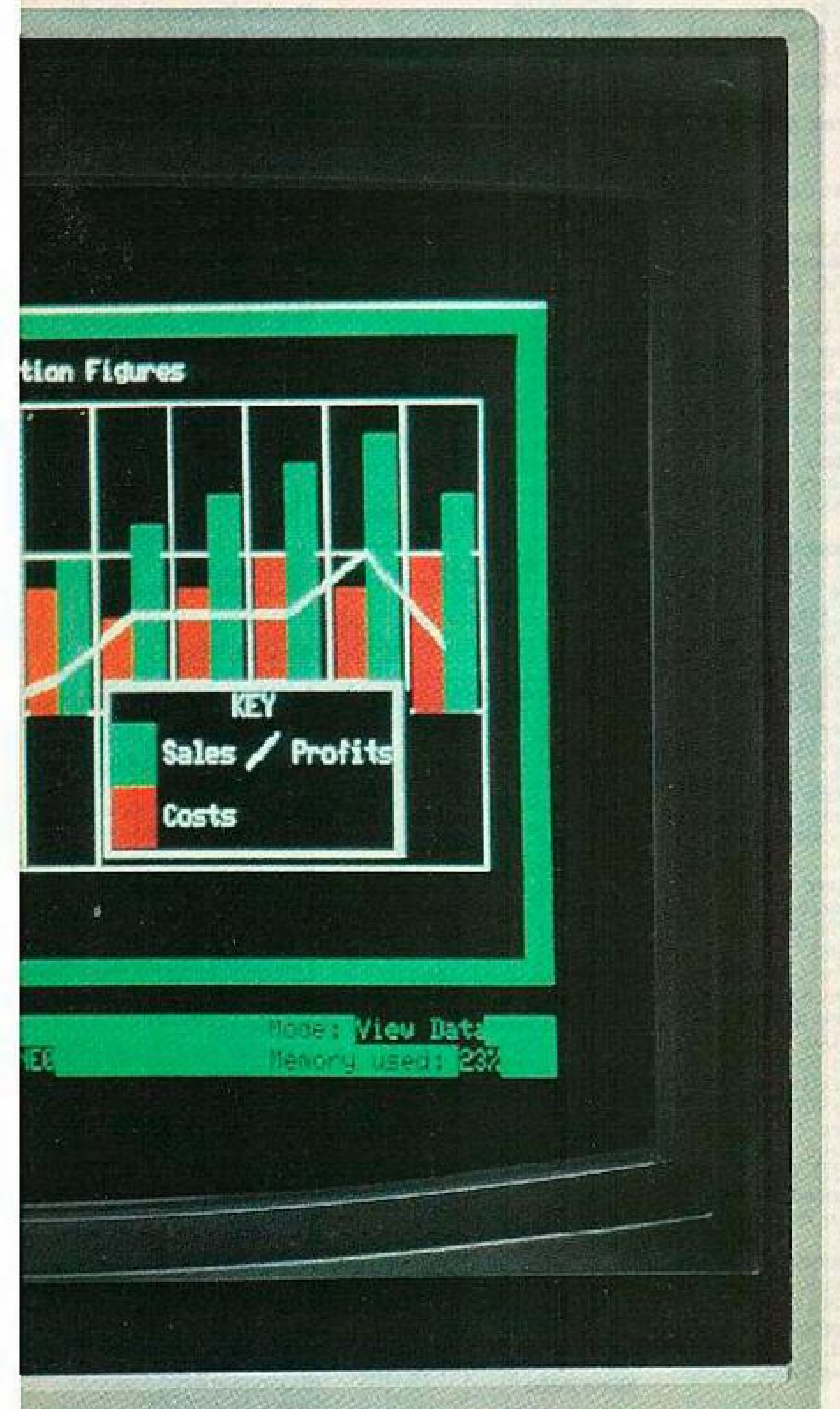
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CentreSoft


DEALERS! - for information on how to become a CentreSoft stockist: Write to-
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New-Sinclair QL
There's no comparison chart, b



The Sinclair QL is a new computer.

Not just a new Sinclair computer, but a totally new sort of computer – nothing like it exists anywhere.

It's not just a bit better than this, or a bit cheaper than that – it's a computer that's very hard to compare with anything. Just check the features below – and if you don't agree, take up the challenge at the end of the advertisement.

If you do agree, there's only one course of action you can take… get yourself a Sinclair QL at the earliest possible moment.

The Sinclair QL has 128K RAM. Big deal?

Several micros offer 128K RAM, or more, as standard. The 'What Micro?' table for December 1983 lists over 50 of them – but 40 of the 50 micros listed cost over £2,500!

The Sinclair QL offers you 128K RAM for under £400, and an option to expand to 640K. That's a lot of bytes to the pound!

The Sinclair QL has a 32-bit processor. Who else?

Under £2,700, nobody. Even the new generation of business computers, such as the IBM PC, are only now beginning to use 16-bit processors.

At prices like this the Motorola 68000 family – widely regarded as the most powerful microprocessors available – will remain a luxury.

Yet with the Sinclair QL, the 32-bit Motorola 68008 is available for less than £400.

You can also be sure that the QL will not become outdated. 32-bit architecture is future-proof.

32-bit processor architecture, 128K RAM, and QDOS combine to give the QL the performance of a mini-computer for the price of a micro.

Exclusive: new QDOS operating system

No competition! QDOS sets a new standard in operating systems for the 68000 family of processors, and may well become the industry standard.

QDOS is a single-user, multi-tasking, time-sliced system using Sinclair's new SuperBASIC as a command language.

One of its most significant features is its very powerful multi-tasking capability – the ability to run several programs individually and simultaneously. It can also display the results simultaneously in different portions of the screen. These are features not normally available on computers costing less than £7,000.

Eleven input/output ports

QL ROM Cartridge slot

2 x Joystick ports 2 x RS-232-C

Expansion slot

New professional keyboard

The QL keyboard is designed for fast input of data and programs.

It is a full size QWERTY keyboard, with 65 keys, including a space bar; left-and right-hand shift keys; five function keys; and four separate cursor-control keys – key action is positive and precise.

A membrane beneath the keyboard protects the machine from dust (and coffee!), and for users who find an angled keyboard more comfortable, the computer can be raised slightly at the back by small detachable feet.



£399
...because there's no comparison!

Advanced new friendly language – Sinclair SuperBASIC

The new Sinclair SuperBASIC combines the familiarity of BASIC with a number of major developments which allow the QL's full power to be exploited.

Unlike conventional BASIC, its procedure facility allows code to be written in clearly-defined blocks; extendability allows new procedures to be added which will work in exactly the same way as the command procedures built into the ROM; and its constant execution speed means that SuperBASIC does not get slower as programs get larger.

2 x Local area network
TV (UHF) Monitor
QL
Microdrive extension slot

Two 100K microdrives built in

The Microdrives for the Sinclair QL are identical in principle to the popular and proven ZX Microdrives, but give increased capacity (at least 100K bytes each) and a faster data-transfer rate. Typical access speed is 3.5 seconds, and loading is at up to 15K bytes per second. The Sinclair QL has two built-in Microdrives. If required, a further six units can be connected.

Four blank cartridges are supplied with the machine.



™ Quil, Easel, Archive and Abacus are trade marks of Psion Ltd.

Included – superb professional software

The suite of four programs is written by Psion specially for the QL and incorporates many major developments. All programs use full colour, and data is transportable from one to another. (For example, figures can be transferred from spreadsheet to graphics for an instant visual presentation.)

Word-processing

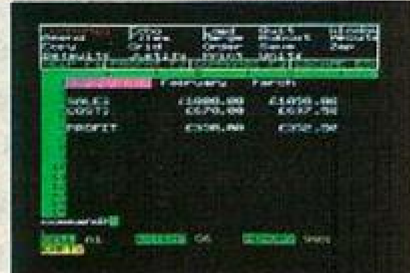


Certain to set a new standard of excellence, QL Quill uses the power of the QL to show on the screen exactly what you key in, and to print out exactly what you see on the screen.

A beginner can be using QL Quill for word-processing within minutes.

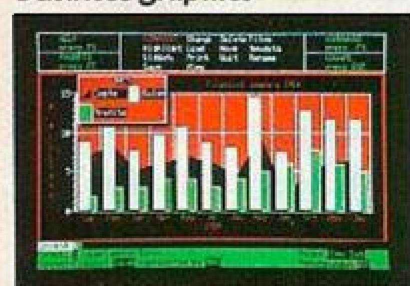
QL Quill brings you all the facilities of a very advanced word-processing package.

Spreadsheet



QL Abacus makes simultaneous calculations and 'what if' model-construction easier than they've ever been. Sample applications are provided, including budget-planning and cash-flow analysis. QL Abacus allows you to refer to rows, columns and cells by names, not just letters and numbers. Function keys can be assigned to change a variable and carry out a complete 'what if' calculation with a single key-stroke.

Business graphics



QL Easel is a high-resolution colour program so easy to use you probably won't refer to the manual. It handles anything from lines, shaded curves or histograms to overlapping or stacked bars or pie charts. QL Easel does not require you to format your display before entering data; it handles design and scaling automatically or under your control. Text can be added and altered as simply as data.

Database management



QL Archive is a very powerful filing system which sets new standards, using a language even simpler than BASIC. It combines ease of use for simple applications – such as card indices – with huge power as a multi-file data processor.

An easy-to-use labelling facility means that you don't have to ask for your file by its full name – a few letters are enough.

New – the Sinclair QLUB

The QLUB is the QL Users Bureau. Membership is open to all QL owners. For an annual subscription of £35, QLUB members receive one free update to each of the four programs supplied with the QL, and six bi-monthly newsletters. Sinclair has also made exclusive arrangements for QLUB members to obtain software assistance on QL Quill, Abacus, Archive or Easel by writing to Psion.

The Sinclair QL challenge

If you're seriously considering any other computer, post the coupon for a blow-by-blow comparison. We'll take a *published* comparison chart for the machine you're considering (not one we've created ourselves) and give you the Sinclair QL figures, detail by detail.

Take action today!

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– complete the coupon and send it to the FREEPOST address below. For credit card holders it may be possible to extend your credit limit. Full details will be sent when we acknowledge your order.

To order by telephone

– phone Camberley (0276) 685311; – have your credit card (Access, Barclaycard, Trustcard) number ready. It may be possible to extend your existing credit limit. Please ask our telephone staff for more details. **Please do not use this number for other enquiries.**

For more information

Phone Camberley (0276) 686100, or use the coupon to get a QL brochure. Due to demand, delivery may take more than 28 days. Your order will be acknowledged immediately with an expected shipment date. Remember that Sinclair offers a 14-day money-back undertaking.

Send to: Sinclair Research Ltd, Computer Division, FREEPOST, Camberley, Surrey, GU15 3BR.

Qty	Item	Code	Item Price £	Total £
	Sinclair QL Computer	6000	399.00	
	QLUB membership (one year)	6100	35.00	
	Postage & packing (any order over £390)	6999	7.95	

Please tick the appropriate box-

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☐ Please charge my Access/Barclaycard/Trustcard Account No. ______

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Address ______

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☐ Please send me a chart comparing the Sinclair QL computer with a ______

☐ Please send me a Sinclair QL brochure

Sinclair Research Ltd, Stanhope Road, Camberley, Surrey, GU15 3PS.

sinclair

Small business can now stop going by the book.

For under £1,000 a small business can now equip itself with a BBC Microcomputer, a disc drive, a word processor and printer.

(All tax deductible by the way.)

Once you've parted with that money, you'll find that business has never been brisker.

Because now, there's a new series of floppy disc software specially for the smaller business.

It has been developed by Acornsoft, the software division of Acorn Computers who are the manufacturers of the BBC Micro.

For only £24.95, each disc can store volumes of vital bookwork which can be updated and amended in a fraction of the conventional time.

And there is a disc to cover most aspects of paperwork and book-keeping.

The Invoicing package.

This program stores details of products, VAT numbers and, of course, the names and addresses of your customers. As orders come in, you simply record them. Then, when it's time to invoice, you just press a few keys and each invoice or credit note is printed automatically in seconds.



Allowing for variable terms of trading, the system calculates and prints discounts. And it should help to improve your cash flow dramatically.

The Order Processing package.

With this program, you can confirm your customers' orders, prepare and print despatch notes and make fast analyses of individual orders or of all the orders stored on disc.



The Accounts Receivable package.

Now, it couldn't be easier to keep your customer accounts under control.

In an instant, you can analyse debtors, produce statements, keep a check on any credit limit and calculate VAT output automatically.



Using this package in conjunction with the invoicing package, you can also keep tabs on payments received against payments outstanding.

The Accounts Payable package.

This package will keep you fully up-to-date on how much you owe and who to. In addition, it calculates



input VAT and, used with the Accounts Receivable package, produces instant VAT returns.

It also highlights settlement discounts, produces remittance advices and provides an immediate analysis of all creditors.

The Stock Control package.

Touch a few keys and you have instant access to stock status and automatic analysis by quantity and value.



Consequently, it's easy for you to maintain correct stocking levels, having an early warning of out-of-stock situations or the likelihood of over-stocking.



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All order data can be recalled in seconds, allowing you to check on orders, and suppliers' invoices and to record all deliveries.

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Instead of the shotgun method of sending mailshots, this package enables you to refine each mailing down to the customers who are most likely to respond.



It gives you a rapidly accessible mailing file of your customers, according to any criterion you choose. Size of company, for instance, or type of business. Average value of the business they do with you, or whether they are good or bad payers.

Then, when you are doing a mailing, you simply choose the group or groups of customers you want.

At £24.95 each, these packages could be priceless.

Each package comes with clear instructions on how to get the program running so that you can devote much more of your time to more profitable activities.

If you're a credit card holder, you can order any or all of the packages by ringing: 01-200 0200 anytime. Or 0933 79300 during office hours.

(By ringing the same number, you can get the address of your nearest stockist, or full details of the BBC Microcomputer system if you don't already have one.)

Alternatively, you can order the packages by sending the order form below to: Acornsoft, c/o Vector Marketing, Denington Estate, Wellingborough, Northants NN8 2RL. Please allow 28 days for delivery.

☎ Credit card holders, phone 01-200 0200, anytime. Or 0933 79300, during office hours.

To: Acornsoft, c/o Vector Marketing, Denington Estate, Wellingborough, Northants NN8 2RL.
Please send me the following business software packages at £24.95 each.

PROGRAM	QUANTITY	TOTAL	(Code Acornsoft use only.)
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Order Processing			SNB 12
Accounts Receivable			SNB 10
Accounts Payable			SNB 13
Stock Control			SNB 11
Purchasing			SNB 14
Mailing			SNB 09
	TOTAL		

I enclose PO/cheque payable to Acornsoft Ltd. Or charge my credit card.

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5" width roll printer. 40 cps printing speed. Graphics capability. All modes can be intermixed on a single line. Alternative colour ribbons optional with replacement ink reservoirs.
Available shortly is a dedicated Sinclair Spectrum version. **£138.00**

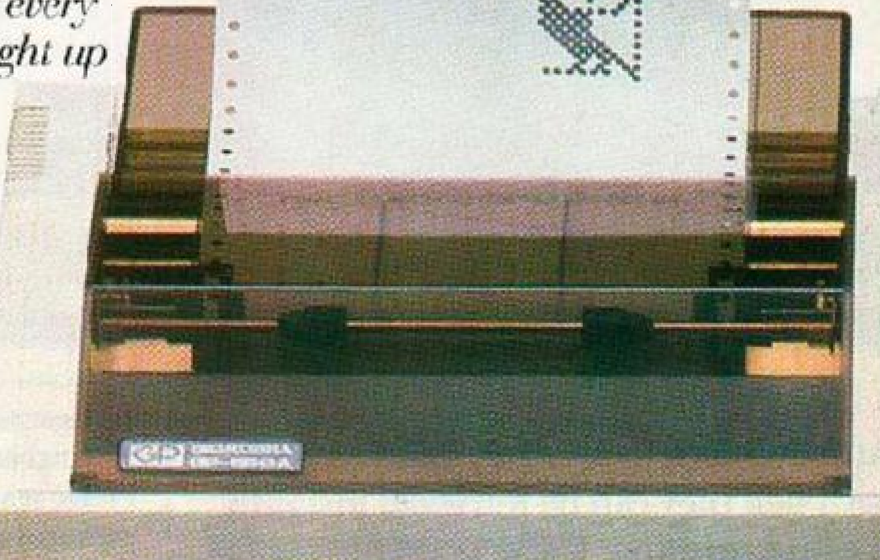


If you want to make the most of your micro, sooner or later you'll need to add on a printer. To help with preparing and debugging programs for example. Or preparation of reports. Or cataloguing, word processing and file listing.

Low Seikosha prices mean you can team up with the printer you want sooner rather than later. The wide range interfaces with virtually every computer from a Dragon or Spectrum right up to Apple and IBM.

Designs are sophisticated, performance is versatile and reliable and quality is all you'd expect from the name Seikosha.

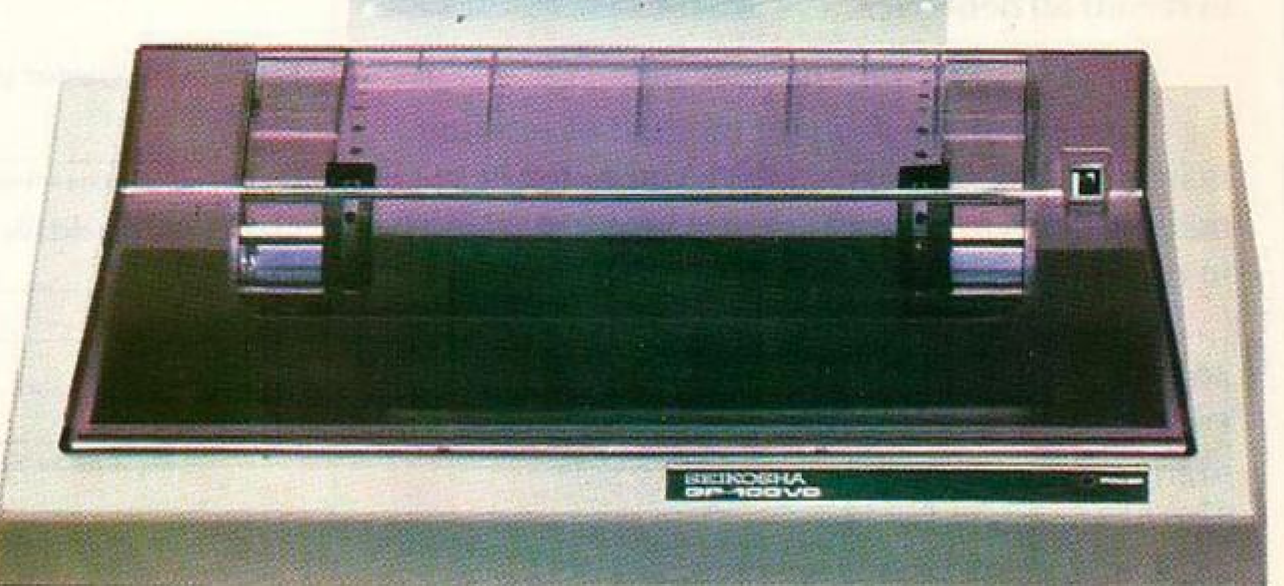
Get hold of the full picture - ask for a demonstration at one of the dealers over the page.



GP 550A CORRESPONDENCE PRINTER
Standard dot-matrix and near letter quality printing. Print speed 50 cps (DP) or 25 cps (NLQ) modes. 8 fonts. **£299.00**

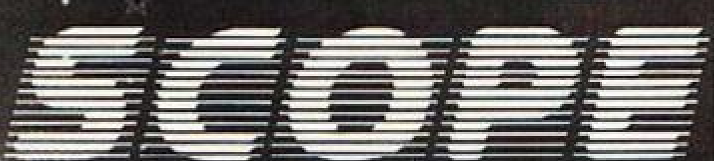


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Built exclusively for VIC 20 and 64. Full graphic printing including all VIC characters. 30 cps printing speed. Supplied complete with dedicated cable interface. **£229.00**



NOMINATED SOFTWARE PROGRAM OF THE YEAR C.T.A

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★ SIMPLER THAN BASIC

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For details of how to get your games published commercially contact ISP Marketing

PRICE **£11.95**

TECHNICAL DETAILS SCOPE is a fully structured multitask language specifically for writing *graphics, animation* and *sound*. Being fully compatible with BASIC it is ideal for writing both arcade and adventure style games. Additionally, with SCOPE present in high memory it can be used as an assembler with SCOPE words as plain language mnemonics. Therefore no knowledge of machine code is required. The language is extremely easy to comprehend and is very powerful indeed providing many features not available from BASIC.

SCOPE HAS TO BE USED TO BE BELIEVED

48K SPECTRUM



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Post to: ISP Marketing Ltd, Crown House, 39b High Street, Godalming, Surrey Tel: Godalming (04868) 24151 Please rush me . . . copies of the SCOPE computer graphics language tape and instruction manual at £11.95 (p&p free).
(Cheques payable to ISP Marketing Ltd)

Block capitals pleas

Name ____________

Address ____________

Dealer Enquiries Welcome

F

SINCLAIR'S NEW Q-LENGTH



Sinclair seem to be going down a familiar path, one would have thought they'd have learned by their experience with the Spectrum — but no.

On February 13 I rang the enquiry number 0276 686100 given in the QL brochure to enquire what the current delivery situation was. I was told it would be 28 days from receipt of order, as this was rather important to me I asked if the lady was absolutely sure about this, she replied "Well it could be as much as five weeks, would you like to order one now?" I did order one but I am now wondering if I did the right thing as what I was told would now seem to have been a blatant lie.

According to recent articles in computer magazines Sinclair were in fact in the process of sending out letters to people who had already ordered to say that there would be a delay in delivery. These letters were already in the process of being sent before I ordered, it seems that the people who ordered in the first week will not receive their QL's until the end of April, that does not give me much chance before the end of May.

I think it is about time Sir Clive started to treat his customers with just a little more respect instead of abusing their faith in his products. It is now two weeks since I ordered and I have not even received the confirmation of order which I was told would be sent in a few days.

If I knew from the start that I would have to wait 12 weeks that would be fair enough, I feel sure all customers would prefer to be told the truth right from the start and plan accordingly — there is no excuse when they know full well that they are not in a position to deliver in the stated time.

Bryan K. Lee,
Nuneaton,
Warwickshire.

MANIC MINER

I was probing through Manic Miner the other day and I encountered a fantastic "Bug". It proves that it is perfectly possible to choose any of the 20 stages to look at and/or begin a game on . . .

It involves typing in a sequence of numbers at the start of a game these are as follows:

6-0-3-1-7-6-0

A boot identical to the one that squashes you at the end of any normal game then appears at the bottom left of the screen next to the dancing figure of Miner Willy.

Then you press a combination of numbers to select the stage desired. For example:

To begin on the 20th stage, the four numbers: 1-2-5-6 have to be held down all at once and released at the same time.

You will then begin on the 20th stage!

To select other stages such combinations as 2-4-5 have to be pressed. By trial and error all can be selected at any one time. But all of them contain a 6 and none of the numbers are more than 6.

Ben Hardyment,
Clapham,
London SW4.

MONSTERS' LAIR

With regard to my Atari program Monsters' Lair which appeared in the February issue of your magazine it would appear that two lines have become corrupted in your printed listing from the supplied tape. In addition the inverse characters have not appeared in their correct form in the magazine. I should therefore be grateful if you could publish the following corrective article within your pages at the earliest opportunity.

Two lines have corrupted during the printing process. The correct versions are shown below:

```
Line 710 IF PEEK (632)<>15 THEN
BONUS = BONUS - 1:SOUND 2,20*
(PRIZE>0),0,15:SOUND 2,0,0,0:IF
BONUS = 75 THEN GOSUB
25:BONUS = 0
Line 3500 ?"AAAAABBBAAAAAA
CCCAAAAAAACCCAAAAAAABBB
AAAAA";
```

But replace 'A' with a normal %
replace 'B' with an inverse control R
replace 'C' with a normal space

In addition the following characters should be printed in inverse form as they appear in the listed lines:

Line 20 ≠
Line 625 0
(within the quotes)
Line 1530 #
Line 3840 SHLD = 90
Line 3840 bon
Line 3850 #.
Line 7110 diff level

Line 7110 initialise
Line 7200 initialising
Line 7200 min
Line 8050 lair
Line 8060 energy used
Line 8070 time taken
Line 8100 OPTION
Line 8100 SELECT

The notes regarding inverse characters are quite important on the Atari machine since they control colour and are required to balance the screen display.

Dave Hitchens,
Blackpool,
Lancashire.

PROGAID BUG

My ZX-81 program Progaid published in March contains a bug which will cause the program to crash if Merge is implemented in Slow mode. It will however work properly in Fast.

To correct the bug three extra bytes have to be inserted in the listing at 16623. The three missing bytes are CDE702 and their insertion means that everything between 16623 to the end, 16937, has to be shifted three bytes down.

The program will now be 402 bytes long ending at 16940. In addition the addresses of the facilities RT-Down, PGM-SVR and Merge will be reduced by three bytes. Merge, for example, now starts at 32450 instead of 32453.

Albert Olivere,
Gibraltar.

ORIC ADDRESSES

Having read S. Tighe's letter in the November 1983 issue of *Your Computer* which listed some Oric memory addresses, I thought that those readers who own Orics, especially those like myself who enjoy dabbling with machine code, may be interested in a few more addresses from ROM routines:

#F412 'PING'
#F415 'SHOOT'
#F418 'EXPLODE'
#F41B 'ZAP'
#F41E 'SOUND'
#F421 'PLAY'
#F424 'MUSIC'

The parameters for the last three commands should be placed as a series of two-byte integers, starting at location #2E1 (737), in the same order as for Basic, before linking to the routine with a JSR.

Also, four of the locations listed in the aforementioned letter, have another use which the author did not give. Locations #26D and #26E (621/2) contain the start address of the screen (normally 48000), and #26F (623) contains the number of lines in the scrolled area of memory. Decreasing the latter and adding to the former — in increments of 40 — creates a "window" on the display starting at the address held in location 621/2 consisting of a number of lines determined by the contents of location 523.

This protects the rest of the display from overprinting and

HELP TO COMPILE GAMES TOP 20

To all micro owners. Have you bought a pre-recorded cassette lately? What standard was it? Whatever your answer, this survey is for you.

I want you to send me a list of your top 20 games you've played on your micro — Vic-20, Oric, CBM 64, ZX-81, Texas, Spectrum, Atari, BBC B, and Dragon. I don't mind if it's your cassette or not. All I want to know is your favourite 20 games in order. Please state the memory required and the company who makes the game. Do your list for one micro only. Please state which on your list and on your envelope.

We will then analyse the results which will then be published later on. We will be able to find the top 20 games for each of the top selling micros.

This will be one of the biggest software surveys conducted in any of the computer books on sale in any newsagent.

Please include your name and address as I hope that some software houses will donate some cassettes as prizes. The prizes will be given to the person who's entry is closest to the one published, if no one is correct then the games will be witheld and added to the prize next time.

We have already completed a small survey using magazines, schools, youth and computer clubs. Please send entries to the following addresses:

Nigel Sutton, 18 Claypole Drive, Northborough, Peterborough, PE6 9DW or Chris Malton, 4 Clare Road, Northborough, Peterborough, PE6 9DN.

scrolling, but to change the colour of only the window it is necessary to Poke 619 with the required background attribute — or any other character — and to Poke 620 with the foreground attribute, then to CLS. This technique can be used to protect headings or to put text under a picture without writing over it.

Two more locations which may be useful are 537 and 538 which contain the hi-res X and Y co-ordinates and can therefore be used in testing for out of range parameters with the Draw or Curmov commands.

Andrew J. Eagington,
Norwich,
Norfolk.

MILLIPODS

In the March issue of *Your Computer*, three errors crept into listing 2 of Millipods:

```
210 IF ASC(B$)>60 THEN etc
230 C = S*16
250 IF ASC(B$)>60 THEN D = etc
```

Peter Tomson,
Tamworth,
Staffordshire.

TUNNEL RUN

People who have entered my program Tunnel Run which was printed in Software File in the March issue will have got an error when running it. This is because the text says the @ character should be typed instead of the £ character. This would have been correct if my listing had been used but because you printed your own it is not. The correct character to be typed is the hash symbol. The lines which will need altering are 410, 1480 and 1750.

If you wish to make stage 2 of the game harder, enter the line 785 M2=6. This will give a roof to the tunnel.

M. Sewers,
Walton-on-Thames
Surrey

STOPPING COPIES

Many people that make their own programs and lend them to friends or eventually sell them become surprised with the quick proliferation of unauthorized copies of their own work.

For owners of Spectrum machines I will suggest a small trick that will make any user have to sweat infinite hours of pain and frustration to copy a private label program.

The non-mergeable/non-stop loader. If your programs are in machine-code load them through a Basic header-come loader of the following type:

```
1 Poke Val "23785", Not PI:Poke Val "23659", Not PI
2 Go To Val "9999"
9990 Rem to save the loader
9995 Poke Val "23785", Val "255": Save "Loader" Line Val "1":Stop
9999 Rem Insert here LOAD"", if Basic or Load ""Code:Randomize USR Address f M/C.
```

Jose Alverto P. Pascoa,
Lisbon,
Portugal.

EDITORIAL

WHILE QL DELAYS MAY be bad news for the early orderers, they could be a blessing in disguise for the rest of us. Every time a new wonder machine appears on the market the supply of software for one of the old favourites seems to dry up.

The million-plus ZX-81 and Vic-20 owners already know what it feels like to be left out in the cold. The flow of commercial programs for these two old-timers slowed to a trickle soon after the Spectrum and the CBM-64 had arrived in a big way, and as the software houses turned their attentions to these new rising markets.

What interests the program-makers are computer users and not computer owners. The hundreds of thousands of Vics and ZX-81s did not just vanish overnight. They either became second-string machines as their owners moved up *en masse* to larger and more sophisticated micros, or were judged by the software manufacturers to have passed their first year of use when most money is spent on buying programs.

Those who stuck with these machines from the outset and those who bought one after their sales had reached a peak are rewarded with a dwindling choice of programs: software houses prefer the areas of increasing demand.

The programming effort that goes into a new computer is enormous. It often pushes the micro's capabilities well beyond the original expectations of both manufacturer and public. Compare, for example, the quality of early Spectrum software with what can be achieved today.

Machines that are in decline do not receive that kind of attention. So not only is no progress made, but they actually go backwards relative to the latest micros. As this software gap widens between old and new machines, yesterday's computers become even less attractive to buyers.

Add to that the fact that commercial programmers are just as subject to the whims of fashion as the average computer enthusiast. Professional program writers prefer to work on the computers that are in vogue. Not only will the royalties involved be higher but the end product is more rewarding. We may find our present generation of Spectrum programmers drawn to the QL by the pull of its 68008 processor.

In the mercurial software market the program-makers feel they must be seen to be up in the forefront, servicing the latest technology. Even if there is still money to be made in the Vic and ZX-81 markets, software houses are afraid to be branded as behind the times by providing new programs for them.

They also maintain that as well as the difficulties of selling software into the static or dying markets of the older machines, the volume of pirated packages that accumulates once a micro has been around for a couple of years makes creating new software a pointless task.

In any case the big multiples like WH Smith or Boots have the final say. Faced with the choice between an excellent new Vic program or one for the CBM-64, the multiple would choose the one for the newer, better-selling machine. That would leave the software house with the fading mail-order market as its only other distribution option — not a very attractive prospect.

The acres of shelf space in the growing number of software supermarkets may offer owners of classic micros a ray of hope. Picture dropping a software flavour of yester-year into your Saturday morning shopping trolley. If that fails to become fact, the image of QL owners in a few years reduced to ferreting around in junk shops for rare programs may be a small consolation.

How to write for *Your Computer*

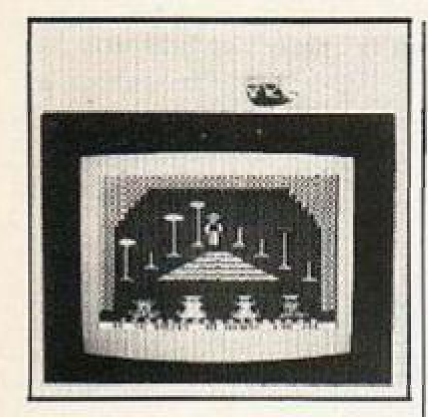
We called this magazine *Your Computer* precisely because we welcome your views, tips and hints and even your criticism of machines and software in general. If you would like to see your name in print, whether on a Software File program or a full-blooded article, here is how to go about it. Ideally, all articles should be typed double-spaced on one side only of uniform sheets of paper. If listings can be dumped directly from a printer — you can always use a friend's or user group's — this minimises the risk of error. In a perfect world a cassette would accompany the article. That considerably speeds up the checking process. Not only do you get to air your own discoveries and opinions, but we will even pay you for the privilege. We pay £35 per published page — that's as it appears in the magazine and includes illustrations.

Why not give it a try? You have nothing to lose but your postage.

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Hungary for a take-away

CHINESE JUGGLER is the first computer game from Hungary. It runs on the Commodore 64 and is sold in Britain by Ocean Software for £6.90. Juggler won an ideas competition on Hungarian TV and was written by a mathematician, an artist and a musician.

Don't call me Elan, Flan, DPC or Samurai — just call me very late



SPRING will be a little late for the Enterprise this year. Chip delays and yet another change of company name mean that the £200 computer will not be released till September instead of April as originally promised.

Last September when details of the micro then called the Elan Enterprise were released its ultra-high resolution, massive range of colours, 64K RAM, built-in word processor and joystick seemed the ideal home computer but it had already had an unfortunate problem with its names. In the early days of the project which was managed by Intelligent Software it had been code named DPC — damp proof course — but it was first advertised as the Samurai Home Computer. Legal action by another micro firm called Samurai forced a change of name and after a brief flirtation with the name Oscar the company settled on Elan.

Unfortunately, Elan Digital Systems of Crawley were less happy with the name the makers of the Enterprise Marketing Manager Mike Shirley told a gullible computer press that he was considering changing the name to Flan but the company is actually negotiating with an American firm to buy a new name with a futuristic Space travel ring about it. Names like Apollo, Gemini and Mercury have been suggested. The change of name will delay the whole project because here will have to be some retocling and changes will have to be made to manuals and advertising materials.

At the same time there have been problems debugging the ambitious Nick and Dave video and sound chips in the Enterprise. The computer will be built by Welwyn Electronics at a plant on Tyneside which will create 90 jobs.

Shaking all over about the pirates

NICK ALEXANDER of Virgin Games is accusing the Government of "endorsing and giving actual support to computer pirates". This follows the Ministry of Defence ban on JLC Data using a new anti-piracy system on the grounds that it might be a threat to national security.

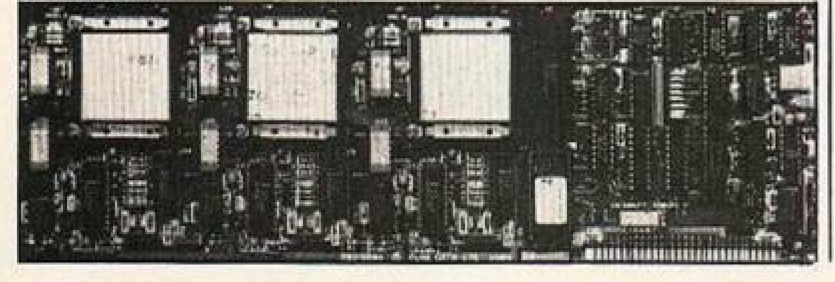
Nick Alexander is asking the Government to "compensate the games industry for the £100 million theft which there is every chance this new system could prevent". At the same time the Guild of Software Houses is trying to persuade magazines to stop publishing advertisements for copy-cat programs.

Bruce Everiss of Imagine calls for the Government to change the law so that computer pirates can be treated in exactly the same way as video pirates Other figures in the record and software industries are calling for a levy on blank cassette tapes.

More 6502 for Acorn

ACORN IS FINALLY releasing its 6502 second processor for the BBC Micro which also gives at least 50K of user memory in any graphics mode.

Shapes of things to come: The 16-bit Grid portable, above, which was used on the space shuttle with its 256K RAM, 384K bubble memory and built-in Modem and flat screen is probably what a typical £300 computer will look like in a couple of years. Below, cheapest bubble memory so far, £600 for a 128K unit to plug into the IBM PC.



Easy one for pocket desk

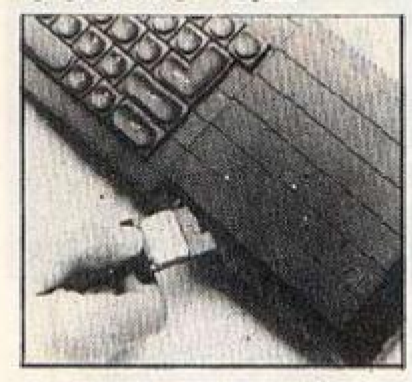
EASY-ONE is an attempt by Elkan Electronics to turn the Sharp PC-1500 pocket computer into an instant work desk. It contains Calculator and Statistics, programs, a 400 word Notepad, an Alarm which can display short messages when it sounds such as "RING DAVID NOW", Text a mini-word processor and a handy currency and measures conversion program. Easi-one costs £25 on tape and it requires an 3K or 16K RAM module and the CE-150 cassette interface.

What William Morris — the nineteenth century artist, writer and craftsman would have made of digital watches or interior designer programs for the Spectrum is perhaps fortunately unknowable. He found it difficult enough to adjust to the mass production of the Victorian age but the Institute of Contemporary Arts is celebrating the 150th anniversary of his birth with an exhibition including a computer generated image of his Red House which can display 16 million different colours — presumably including red.

At the same time Richard Williams has set up his own cottage industry producing Spectrum Interior Designers programs which allow you to try out different layouts of furniture on screen. Phone 061 440 0333 for Richard Williams. The ICA exhibition is on at the Mall in London till 29 April.



Microdrives but no QL



EVEN IF SINCLAIR holds to his promise and supplies the first QLs to customers this week most of the thousands of people who have already ordered will have to wait three or four months instead of 28 days for delivery. Sinclair is already quoting delivery dates well into June for those who sent their order forms in at the end of January.

A few QLs which have found their way out by backdoor means and with incomplete ROMs have been changing hands for high prices behind the scenes as software houses race to be the first to produce QL games and applications.

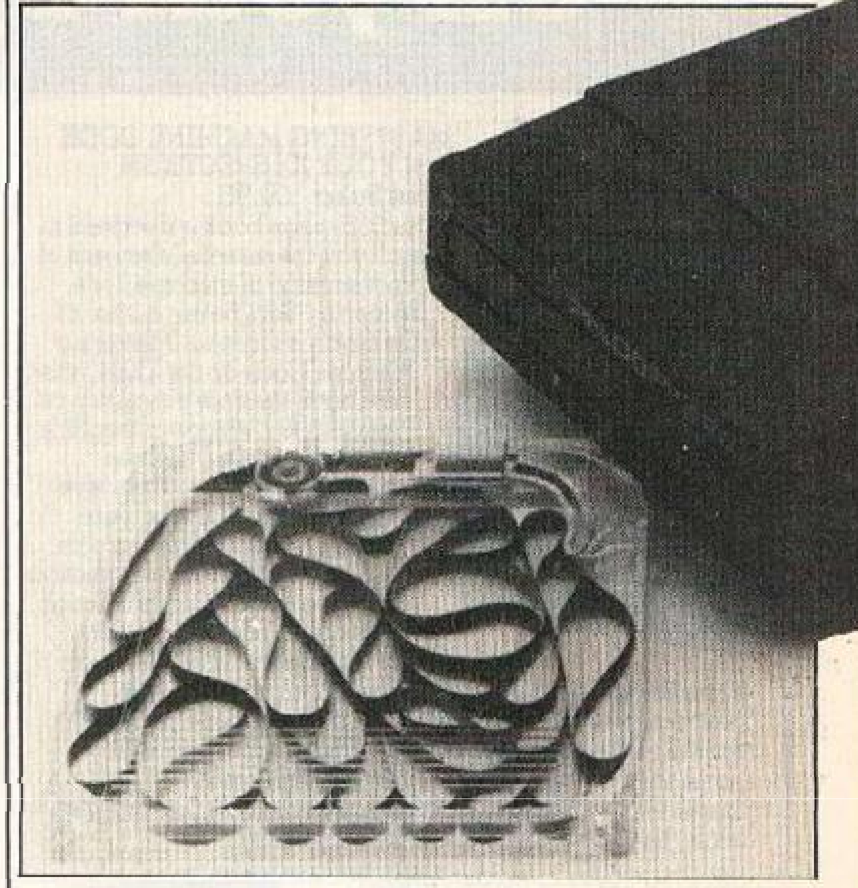
That's no tape recorder — its a mass storage system

TWO NEW high-speed tape drives, the £80 Ultra-Drive and the £120 Floopy, claim to offer disc-style mass storage for a fraction of the price.

If the claims sound familiar from Sinclair Microdrive advertising that is because the technology is similar. Phloopy, from Phi Mag Systems in Falmouth uses a continuous loop of tape in a cassette which passes a nine-track recording head. Unlike the Sinclair the tape is not twisted over on itself.

Eight of the tracks carry data giving each a cassette a capacity of 100K, and the ninth tracks for error correction. Phi Mag claims an average access time of just three seconds and with a data transfer rate of 10K bytes a second it takes just another three seconds to load a 32K program.

Ikon's Ultra Drive which uses a conventional Philips mini-digital cassette is slower but costs only £80 as opposed to £115 for the Floopy. Access times can be as slow as 90 seconds but capacity is 200K per cassette. Initially Ikon, on 099-421-515, will produce Dragon and BBC versions of the Ultra-Drive with Oric, Electron and Commodore variants to follow in the Summer. The Floopy is BBC only but Phi Mag hope to make other versions available later.



International links of Spectrum mob

AFTER DESIGNING everything from guided missiles to robot submarines you might think that inventor Brian West would find making Modems for home computers rather unexciting — but not a bit of it.

His new Spectrum Modem will allow you to transmit programs or play interactive games with other Sinclair owners abroad or in other parts of the country. He has spent the last month testing the new half-duplex unit with connections between his Bristol base and identical machines in London, Paris, Lisbon and Copenhagen.

Micron Eye for the Commodore 64 adds vision to your computer. Details from ESI (0256) 57166.



Brian West is not the only one producing new Modems. This is Minor Mirades WS2000.



Brian West started by producing simple £50 acoustic couplers for the ZX-81 and Spectrum under the name of MicroMyte. His new unit uses a half-duplex Modem which senses how good a telephone line is and adjusts its speed to send the data as quickly as possible.

At first it tries to send data in blocks of 500 bytes each with a checksum to make sure that interference on the line has not caused errors. If after three tries it cannot send a block through it will change down a gear and send data in blocks of half that size. Eventually if the line is bad enough it will go all the way down to 32 byte blocks.

In practice Brian West finds that except in the busiest periods when the telephone lines are noisy he can send data at top speed in 500 byte blocks though on some international lines the Modem changes down to quarter speed.

Jupiter Ace, Forth micro at a third of the price

AT LESS than a third of its original price the £26 Jupiter Ace being sold by Boldfield Computing becomes the cheapest home computer ever sold in Britain. Boldfield is selling off the remaining stocks of Jupiter Cantab which went into liquidation last year.

RAMpacks and software for the Forth based computer are also available which may cheer up any owners who are sickened at the thought that they paid £89 for their Aces less than a year ago, and now find themselves without support. Boldfield is on 0487 840740.

Vadas is what Voice Input of St Ives is calling its new speech activated room designed for the disabled. It consists of a voice entry connected to a micro with a disc drive which allows a disabled person to use a cassette player or dial a phone number, open or close curtains and turn on and off a fire, all without touching anything.





Philips new £70 12in. monochrome computer monitor keeps the family TV clear for Coronation Street, but at that price it is competing with larger second hand colour sets for a place in the computer room.

YOUR COMPUTER TOP 20

Game	Company	Machine
Atic Atac	Ultimate	Spectrum
Boogaboo	Quicksilva	CBM 64
Caverns Khafka	Centresoft	Atari
Chequered Flag	Psion	Spectrum
Chinese Juggler	Ocean	CBM 64
Chuckie Egg	A&F Software	BBC
Computer Wars	Thorn EMI	Vic-20
Cyrus is Chess	Psion	Spectrum
Cragrunner	Cablesoft	Dragon
Flight Simulation	Psion	Spectrum
Hobbit	Melbourne House	Oric
International Football	Commodore	CBM 64
Lunar Vic 20	Ultimate	Vic-20
Manic Miner	Software Projects	Spectrum
Maze Death Race	PSS	ZX-81
Mushroom Mania	Arcade	Oric
Space Shuttle	Microdeal	Dragon
Stonkers	Imagine	Spectrum
Twin Kingdom Valley	Bug Byte	BBC
Zaxxon	Centresoft	Atari

OK Mugsy we've put Sherlock Homes on your tail so watchout

MELBOURNE HOUSE'S staff went crazy when Manic Miner came out last year — "we lost a week of programmer time when that came out" confesses company boss Fred Milgrom. What with that and Ultimate Play the Game's arcade style graphics Milgrom had to admit that "these games were technically far superior to what we were coming up with".

To be fair Melbourne House had produced a similar effect on the other software houses with its cult adventures like the Hobbit but Fred Milgrom is determined to get back on top in arcade games too. The first stage is to mix adventure themes with arcade graphics as in Mugsy — the gangster game Melbourne House is about to release — but meanwhile back in the company's secret base, somewhere in the Antipodes, a team of programmers are working on arcade and adventure blockbusters for release later in the year.

The company is keeping the details of its forthcoming action games close to its chest but loyal Australian Philip Mitchell "I wouldn't leave the place for anything" who wrote the Hobbit gives some clues to the adventure plans. He is just putting the finishing touches to Sherlock Holmes.



Although it uses the same language analyser as the Hobbit, Philip has made improvements so it can take sentences like "I think the vicar killed Sir Henry in the conservatory with a blowpipe," — very useful if you happen to be a Victorian detective. Philip also wants to produce a "sausage machine" to take the hard work out of adventure writing.

Shakespeare on silicon will test your English revision to the limit

IF YOU BELIVE what Penguin says the company's new computer-based Study Software is "the first truly revolutionary breakthrough in the study of literature since the invention of printing." Only time will judge whether the Study Software revision aids which are aimed at students preparing for "O" levels and CSEs prove to be more significant in human history than the invention of the blackboard or teach the mass of the population to read and write, but Penguin hopes eventually to produce Study Software for all subjects.

The first set of Penguin programs deal with six of the examiners favourite Shakespeare plays, Macbeth, Romeo and Juliet, Julius Caesar, Merchant of Venice, Twelfth Night and the first part of Henry IV. You cannot throw away your books just yet though. The program gives comments on particular themes and characters in the play, but you will have to leaf your way through to the line reference.

Where the Study Software beats traditional pocket guides to the plays is in its cross referencing. In Macbeth for instance you can call up any of seven main characters plus the witches, and match them with over 20 themes. you can call up Macbeth and match him with themes like Ambition, Loyalty and Treachery.

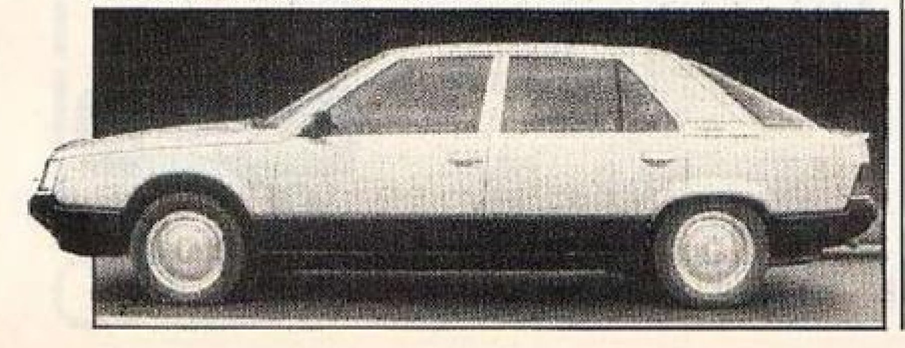
You can even cross reference different themes — like blood and water. Not surprisingly the authors are two secondary school teachers, John Mahoney and Stewert Martin. They have tried out the programs in their own classes but they stress that the Study Sofware is mainly aimed at home revision.

That is why the titles will be released first on the Spectrum at £5.95 each this month with the BBC and Electron versions to follow in May.

Geography revision is the target for TSSL's map reading program for the 48K Spectrum. The £8 program explains and then tests co-ordinates, grid references, longitude and latitude, map scaling and map key reading. Once you've mastered map reading you could always turn to John Dawson's use of computers for map writing on page 98 of this issue.



Renault's new slippery customer — the low drag Renault 25 boasts a 0.28 drag co-efficient — the lowest so-far of any production car but inside it relies on a microprocessor from the 6800 family and a ROM full of synthesised speech to justify its claim that the 25 makes "the most extensive use of electronics yet seen in a large-scale production car."



blaby computer games

DRAGON 32 SPECTRUM

BARMY BURGERS
DRAGON



BLABY COMPUTER GAMES

BARMY BURGERS
Baps Burgers, Cheese and Lettuce — they are all there, all you have to do is put them together. It sounds easy doesn't it but not when you are being chased by a fried Egg and Sausages! **D/S**

D — Dragon 32K M/C £5.95
S — Spectrum 48K M/C £4.95

DODO
Starring Dodo and the Snow Bees — You are the last surviving breed of Dodo's alone in the antarctic surrounded by Ice Blocks and Snow Bees. Slide the Ice Blocks onto the Snow Bees or electrify the walls to kill them. **D/S**

ACE TRUCKING CO

SPECTRUM 48K

ACE TRUCKING CO
Foot hard down, drive like hell through wave after wave of the most incredible characters imaginable. Hook up your trailer and Go Man Go! Super smooth graphics, fab sounds over 18 waves. **Spectrum 48K M/C £4.95**

CHOPPER RESCUE
Scientists are being entombed under Radio Active waste, can you as a Helicopter Pilot, rescue them all in time!
Spectrum 48K M/C £4.95

PLUGGITT
Young Percy Pluggit must get back to this circuit board in time. Please help him find the right keys! **Spectrum 48K M/C £4.95**



LASER RUN
Fly the trench to destroy the T.I.E. fighters. This game is shown in 3D perspective.
Dragon £5.95

KILLER KONG
Featuring five screens of arcade action — Elevators — Kong — Mario — Barrels — Hamburgers and even Mario's girl
Spectrum 48K M/C £4.95

'GOTCHA'
SPECTRUM 48K



BLABY COMPUTER GAMES

GOTCHA
After escaping from the local Nick, Ernie is soon back up to his old tricks again.
Spectrum 48K M/C £4.95

HIGHRISE HARRY
Featuring Harry Highrise and the Rust Bugs — Guide Harry the Painter along the Girders, up the Ladders, onto the Lifts but mind the Slides. Five Whacky screens. **Spectrum 48K M/C £4.95**

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What the competition hasn't been waiting for.



Latest version of Forth for the BBC (Is not rehashed Forth 79 Code)

Unique Stack Display Utility

16K Eprom type 27128

Multi-tasking operating system for Real-Time use.

Here's the Forth Eprom for the BBC Micro that makes all others out of date.

It's Multi-Forth 83 from David Husband who has built his reputation for Quality Forth products with his ZX81-Forth ROM, Spectrum Forth-I/O Cartridge and now New Multi-Forth 83 for the BBC Micro. This is not rehashed Forth 79 Code, but a completely new version of the Forth 83 Standard. It's unique in that it Multi-tasks, and therefore the user can have a number of Forth programs executing simultaneously and transparently of each other.

Multi-Forth 83 sits in the sideways ROM area of the BBC along with any other ROMs in use. It is compatible with the MOS, and specially vectored to enable a system to be reconfigured. It contains a Standard 6502 Assembler, a Standard Screen Editor, and a Unique Stack Display Utility.

With this Forth, David Husband has provided the BBC Micro with capabilities never before realised. And being 16K rather than 8K is twice the size of other versions. Multi-Forth 83 is supplied with an extensive Manual (170 pages plus) and at £40+VAT it is superb value.

Order it using the coupon adding £2.30 p&p (£5 for Europe, £10 outside) or if you want more information, tick that box instead. Either way, it will put you one step ahead of the competition.

Please send me Multi-Forth 83 for BBC Micro. £40+VAT. De-luxe System inc. Disc £80+VAT. Cheques to Skywave Software Readers' A/C (or enter Visa No.)

Name ____________
Address ____________
____________ Post code ____________

Please send me more information:
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☐ ZX81-Forth ROM
☐ Spectrum Forth-I/O Cartridge

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Skywave SOFTWARE

MULTI-FORTH 83 FOR THE BBC MICRO

BEGINNERS first bytes

Starting out in home computing? First Bytes is for you. Just write to *Your Computer* with any hardware or software problems, no matter how small or simple.

I could do that...

Tonolamatl is quite a simple programming task for home computing. You can easily code a program — according to the flow chart — which will fix a selected Aztec Name-day for a period of 13 years. Nobody but the Aztec priests could tell that in those times: The same Name-day appeared namely in different months, sometimes even twice a year. Now, your home computer will solve this Aztec Calendar problem.

Tonolamatl, or "book of the days" includes 260 Name-days which were the basis of the Aztec Ritual Calendar. This Ritual Calendar was expanded by nine continuos cycles in a basic 2340 days calendar period, i.e. 6½ years.

The 260 different Name-days were a combination of a number between 1 to 13 and one of 20 days — 13 x 20 = 260.

The following 20 days formed an Aztec "month":

(continued on page 53)

Spectrum UDGs

THE ABILITY TO DESIGN and use your own graphics set is important in so many applications — arcade games, chess, chemistry and Russian come to mind. A large proportion of programs in this magazine include them.

The 7th program in the Horizons tape is "character generator". This excellent program makes it easy and fun to generate your own characters. However, the next step, earning more about UDGs, is a major hurdle. The ZX handbook does not give enough help. This article is written to give more help. The article is designed to be used at the key-board of the Spectrum, entering the programs, and experimenting with them.



Let us suppose that the learner has used the Horizons 'character generator' to design a few interesting and potentially useful characters. First of all, it is important to understand that clearing the program by Break and New, and not by switching off, the graphics set is retained by the memory.

Suppose the symbol was stored as "Graphics A". It can be displayed by entering

PRINT "(Graphics) A"

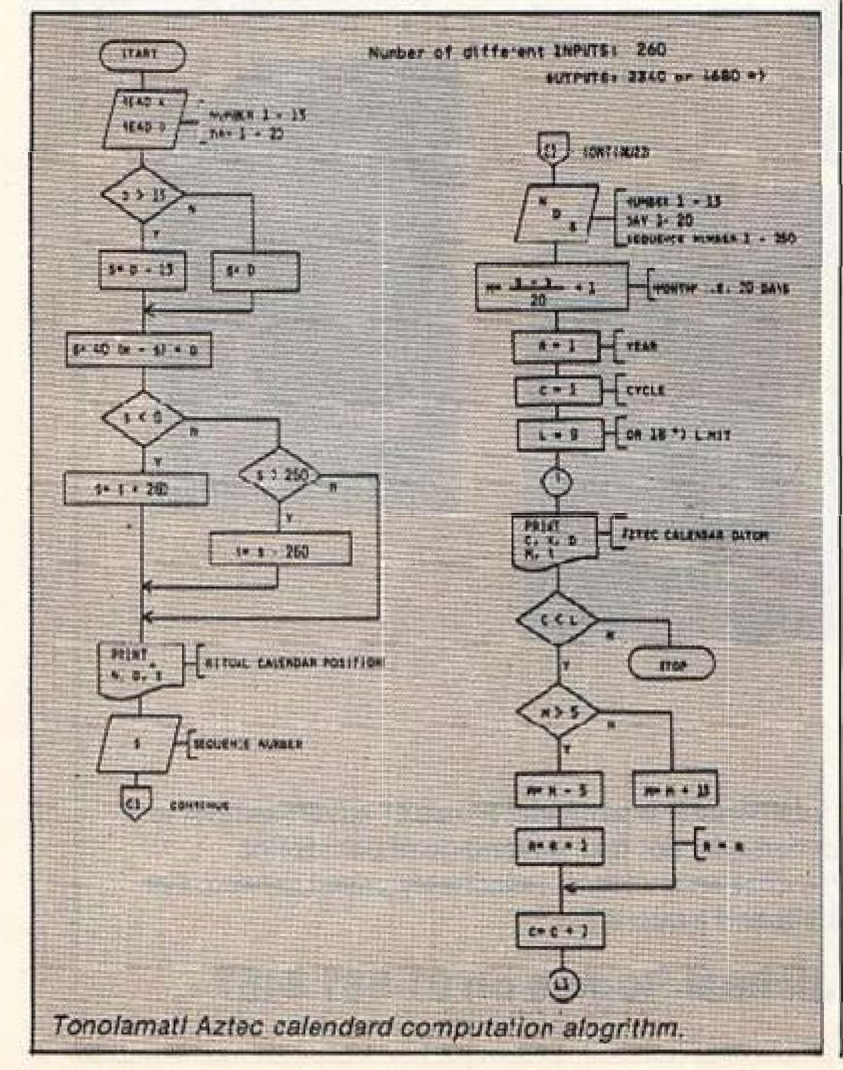
or by entering

PRINT CHR$ 144

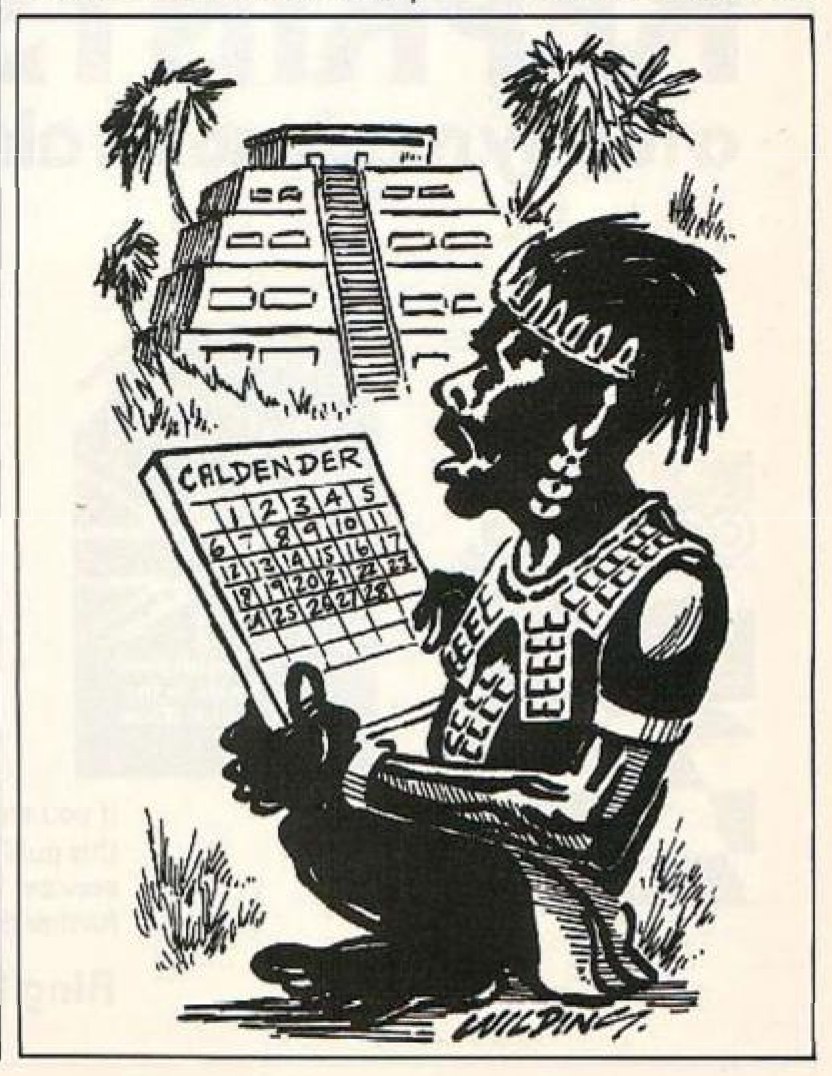
The second method is particularly important. It is used in this one-liner to print the complete graphics set:

```
1 FOR n=0 to 20: PRINT CHR$
```

(continued on page 53)

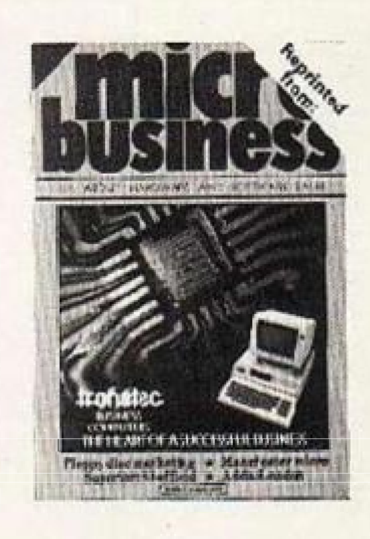


Tonolamatl Aztec calendard computation alogrithm.



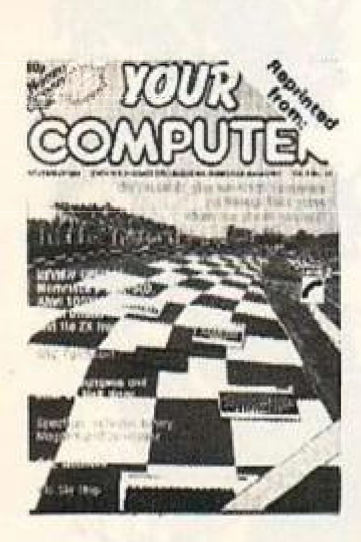
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I could do that...

(continued from page 51)

Week one	Week two
1 ALLIGATOR	6 DEATH
2 WIND	7 DEER
3 HOUSE	8 RABBIT
4 LIZARD	9 WATER
5 SERPENT	10 DOG

Week three	Week four
11 MONKEY	16 BUZZARD
12 GRASS	17 EARTHQUAKE
13 REED	18 FLINT KNIFE
14 JAGUAR	19 RAIN
15 EAGLE	20 FLOWER

By combining the number series and the day series you get "One-alligator" as the name of the first day; of the second, "Two-wind"; of the third, "Three-house" — until you reach the day "Thirteen-reed". The following day is called "One-jaguar"; the next, "Two-eagle", and so on.

There were 18 Aztec "months" 16 × 20 = 360 days — plus one anonymous week — 360 + 5 = 365 days — in a year.

If one was called Four-monkey — 4-11 — his Name-day fell in different months than his friend's who was called Three-monkey. You need a computer program to find out the Name-days. Good luck!

Nobody found February's Pascal's Triangle problem very taxing. From a large number of entries the first to be picked from the bag came from R. Nicol, 22 Hawks Park, Saltash, Cornwall.

```
10 CLS : PAPER 7: INK 0: INPUT
 "Enter number of lines required
 ";c: CLS
 20 DIM A(c): DIM B(c): LET A(1
)=1: LET B(1)=1: PRINT "1"
 30 FOR a=2 TO c
 40 PRINT : FOR b=2 TO a: LET A
(b)=B(b)+B(b-1): PRINT A(a-1);"
 ";: NEXT b: PRINT "1"
 50 FOR x=1 TO a: LET B(x)=A(x)
: NEXT x
 60 NEXT a
```

	BINARY NUMBER	DECIMAL
	128 64 32 16 8 4 2 1	
BIN	00000000	0
BIN	00000000	0
BIN	00000010	2
BIN	00111100	60
BIN	01010100	84
BIN	00010100	20
BIN	00010100	20
BIN	00000000	0

Expanded diagram of PI symbol.

BEGINNERS first bytes

(continued from page 51)

```
(144 + n): NEXT n
```

Before carrying on, try using this one-liner. See how it works by looking up code of the characters in the ZX Guide, page 186.

Now for the next step. Look at the PI symbol set out on page 93 of the guide. Included herewith is an expanded diagram of the symbol, with the value of each column, the Binary value of each row and also the decimal equivalent of the Binary number.

The PI symbol may be entered into the "Graphics P" location in the Spectrum's memory using program 1. When the input "r" is called for in line 80, the numbers may be entered either in decimal — e.g. 84 in the 5th row — or binary — in this case as "BIN 01010100" —You may even mix binary rows and decimal rows in the same figure being defined.

The Binary number relates quite obviously to the shape of the graphics character. To convert the Binary to decimal, add up the column values of each binary "1". So Binary 01010100 is decimal (64+16+4)=Decimal 84. Check the figure for PI, row 5, until you are quite certain that you have grasped this.

There are two things to note in connection with program 1. Firstly, you can replace line 90 by this line

```
90 POKE USR "P" +n,r
```

Secondly, you can use Read and Data to Input the rows.

Program 2 shows how the graphics for PI can be entered into the Graphics P location by using the Read/Data feature.

Program 1

```
 10 REM "defUDG"
 30 CLS: PRINT: PRINT: "Row"
 40 FOR c = 1 TO 8
 50 PRINT AT 3+c,12;c
 60 NEXT c
 70 FOR n = 0 TO 7
 80 INPUT "Next Row ":r
 90 POKE USR CHRS 80 + n,r
100 PRINT AT 4 + n,16;r
110 NEXT n
120 PRINT: PRINT TAB 12:CHRS
80.CHRS 159
150 STOP
9990 SAVE "defUDG" LINE 10
```

Program 1a (to add to program 1)

```
 10 REM "defUDG"
 20 FOR m =0 TO 20
 90 POKE USR CHRS (65 + m) + n,r
120 PRINT: PRINT TAB 12:CHRS
    (65 + m). CHRS (144 + m)
130 INPUT "Press ENTER to
    continue ":Z$
140 NEXT m
```

Program 2

```
10 REM "defUDG"
20 FOR n = 0 TO 7
30 READ a
40 POKE USR CHRS 80 + n, a
50 NEXT r
60 PRINT "Graphics ": CHRS 80;"
   gives U.D.G. ";CHRS 159
70 DATA 0.0.2,60,84,20,20,0
80 STOP
```

So far, entering a single character has been considered. A complete set may be entered by adding the lines of program 1a to program 1, or by using program 3, in which the Data lines — starting at line 70 — will yield the graphics set I wrote for a few Chemistry programs.

Program 3

```
 10 REM "defUDG"
 20 FOR m = 0 TO 20
 30 FOR n = 0 TO 7
 40 READ a
 50 POKE USR CHRS (65 + m) + n,a
 60 NEXT n
 70 NEXT m
 80 DATA 24.36.36,36,24,0,0,0,2.4.
    36.8.16,60 0.0.0,56,4,24,4 56,0.
    0.0.0,0.0.24.36.36,36,24,0 0.0.
    24,36.8.16 60.0.0.0.56 4,24,4,56,
    0.0.0.32.32.40,50.8
 90 DATA 0.0.0.60.32,24.36.24,0.0.
    0.16.32.56 36,24.0,0.0 60.4.8.8.
    8.0,0.0.24.36.24.36,24 8,8.62.8
    8.0.0.0.0.0 60.0.0.0.0.0.28.16.16.
    16.16.16,16,28,56,8,8.8,8,8,56
100 DATA 0.4,2.255.0.255,64,32,0,0.
    0.0,108.146.108,0,0,0.28,32,120.
    32,28.0,0.5,10,18,34,66,231,0,0.
    231,68,120.68,66.231.0,0.8.20.
    20.34.62.0,0
110 CLS: PRINT TAB 3;"CHRS" TA
    B 11; "Graphics"; TAB 23;
    "U.D.G.": PRINT
120 FOR b = 0 TO 20
130 PRINT TAB 3; 144 + b; TAB 15;
    CHRS (65 + b) TAB 25; CHRS
    (144 + b)
140 NEXT b
150 STOP
```

By this stage, you may have wondered about reading a graphics set, such as those you may have generated using the Horizons character generator. Program 4 does this, dismantling my chemistry graphics set.

Program 4

```
 10 REM "UDGlist"
 20 FOR m =0 TO 20
 30 PRINT CHRS (65+ m); TAB 2,
    CHRS (144 + m);
 40 FOR n = 0 TO 7
 50 PRINT TAB 5 + 3*n;PEEK
    (USR CHRS (65 + m) + n),
 60 NEXT n
 70 PRINT
 80 NEXT m
 90 STOP
9990 SAVE "UDGlist" LINE 10
```

Program 4. Printout.

A	⁾	24	36	36	36	24	0	0	C
B	³	24	36	8	16	60	0	0	C
C	'	56	4	24	4	56	0	0	C
D	,	0	0	0	24	36	36	36	24
E	,	0	0	0	24	36	8	16	60
F	,	0	0	0	56	4	24	4	56
G	.	0	0	0	32	32	40	60	8
H	,	0	0	0	60	32	24	36	24
I	.	0	0	0	16	32	56	36	24
J	.	0	0	0	60	4	E	B	8
K	,	0	0	0	24	36	24	36	24
L	→	8	8	62	E	E	C	0	0
M	—	0	0	60	C	C	C	0	0
N	|	28	16	16	16	16	16	16	28
O	|	56	8	8	E	E	E	8	56
P	⇌	0	4	2	255	C	255	64	32
Q	∽	0	0	0	C	108	146	108	0
R	⋞	0	0	28	32	120	32	28	0
S	⋏	0	5	10	18	34	66	231	0
T	K	0	231	68	120	68	66	231	0
U	♧	0	8	20	20	34	62	0	0

The final problem is how to save and use your UDG set. This depends on whether you have a 16K or a 48K Spectrum. I think it is rather wasteful to use a Read/Data structure to re-define a graphics set each time, and use this approach.

Suppose you have a UDG set in your memory. You may, for example, have entered and run program 3, Newed it, and entered program 4 to dismantle it. New to clear the program, without switching off.

Next, enter program 5 without typing in line 9000. Run the program, which displays the graphics set, and then add line 9000. Be sure to use the correct codes in lines 9000 and 9995. The program and the graphics set are Saved in two sections by Goto 9990 — and Enter. Watch for the second "start tape then press any key" message. The program will auto-start — again in two sections — by simply Load"".

The lines between 10 and 8999 are available for any program you like to write, using the UDG set.

Program 5

```
 10 REM "UDG48"
 20 PRINT" User Defined
    Graphics
 30 PRINT: PRINT " CHRS
    Graphics U.D.G.": PRINT
 40 FOR n = 0 TO 20
 50 PRINT TAB 3; 144 + n;
    TAB 15; CHRS (65 + n);
    TAB 25; CHRS (144 + n)
 60 NEXT n
 70 STOP
8010 GO TO 10
9990 SAVE "UDG48" LINE 9000
9995 SAVE "UDG48" CODE
    65368,168
```

With graphics set in this memory, Run program 5 without line 9000. Now add line 9000, and the demo program is ready to Save by Goto 9990.

```
9000 LOAD "UDG48" CODE 65368
```

For 16K Spectrum, substitute

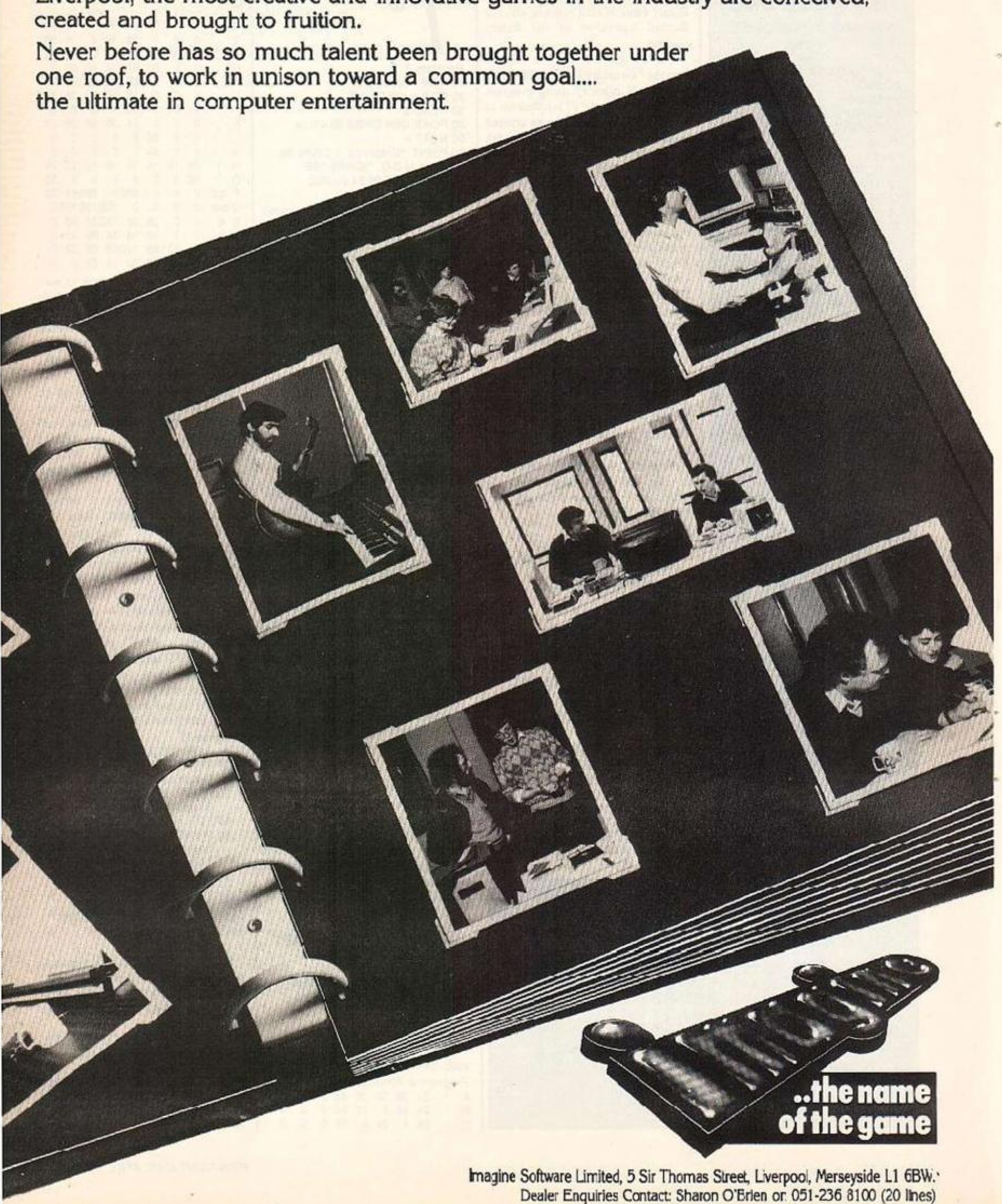
```
  10 REM "UDG16"
9000 LOAD "UDG16" CODE 32600
9990 SAVE "UDG16" LINE 9000
9995 SAVE "UDG16" CODE
    32600,168
```

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Local news

Stoke on Trent

The Mixed Bytes Computer Club meets at Dilhorne Recreation Centre, New Road, Dilhome near Stoke-on-Trent every other Thursday between 7.30 and 9 p.m. All users are welcome. Call Mr A Cope on 0782-396003.

Long Eaton

The ZX Spectrum Club in Long Eaton, Nottingham, is a non-profit making organisation dedicated to the care and rehabilitation of Spectrum owners. For more details contact P Riley, 63 Kingsley Crescent, Sawley, Long Eaton, Nottingham NG10 3DA.

Arun

Arun Microcomputer Club gets together at Wick Amenity Centre, Littlehampton, West Sussex on the first Monday of every month at 8 p.m. and the third Sunday of every month at 6 p.m. Contact P Cherriman, 7 Talbot Road, Littlehampton, West Sussex DN17 7BL. Telephone 09064-7607.

Shrewsbury

Shrewsbury Micro Club meets at Shrewsbury Shirehall once every two weeks. Contact Mr V Ives, 6 Bramley Close, Severn Meadows, Shrewsbury. Telephone: 0743-55024.

Mid-Kent

The Mid-Kent Micro Club has freed itself from association with the TRS-80 and all computerniks are now welcome at the Maidstone Teachers' Centre, Sittingbourne Road, Maidstone between 7 and 10.30 one Friday a month. Contact M K Gates at 66 Buckland Road, Maidstone, Kent.

COMPUTER club

Paul Bond visits Guildford to find out what computers offer in the way of aids to the handicapped.



A NEW VENUE — THE Stoke Hotel, Stoke Road, Guildford — may have thrown a few members but nevertheless there was a good turnout when *Your Computer* visited the West Surrey Computer club recently. The evening was dedicated to micros in the service of the disabled as club chairman Fred Tickle explained.

Tony Isles from the Foundation for Communication for the Disabled started the evening off by demonstrating applications for the Microwriter. This is a hand-held keyboard with liquid crystal display and 8K onboard CMOS RAM which was originally designed some years ago as a king of high-tech notebook not specifically aimed as the disabled.

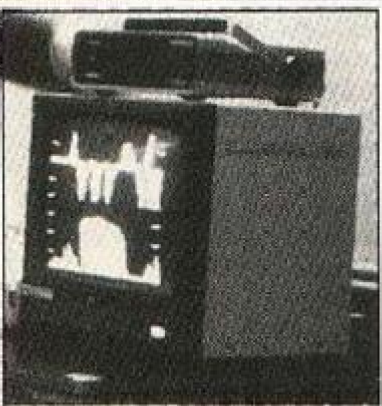
The Microwriter uses a five-key system to generate text; you have to learn different combinations to generate different characters. This is of obvious use to someone whose handwriting is getting spidery and shaky — as in the case of a multiple sclerosis sufferer. But versions have been developed which do not even require hands. Mr Isles demonstrated a Microwriter controlled by breathpower. Lights in place of buttons on the keyboard indicate what notional buttons are being pressed; when you release the mouthpiece, the letter comes up on the LCD.

This means children with disability can be integrated in normal schools because they have a means of writing that they can carry around with them and which is independent of the mains supply, unlike the bulky electric typewriters that they are often forced to use.

An interesting application of computerised voice synthesis which benefits blind people was also demonstrated.

They can play their Microwriters into a voice synthesiser which can either spell, or read out what they have keyed in. Future developments include bigger program dictionaries so that the machine will be able to pronounce words like "Wednesday" as we do, rather than separating each syllable.

Peter Bell put the emphasis on education. He teaches at the Lord Mayor Treloar College, a school for handicapped in Alton, Hampshire. While many of this 250 pupils make use of Microwriters, they don't solve everything. Some youngsters are not highly-motivated enough to learn the codes. Another system used is the MacApple computer — an Apple with special software which allows you to use the whole keyboard, part of it, or just one button as a scanning device.



Above: demonstrating a Microwriter adapted for breath control. Left: the BBC Visispeech set-up for deaf speech education.

One child with speech disability was experiencing considerable difficulty in writing — a line of typewriting might be his entire output for the day, leaving him exhausted. Communication with the outside world was a real problem. Using the MacApple, together with a joystick, instead of his expanded keyboard connected to a typewriter by failure-prone solenoids and wires, he generated so much text on his first day of use that he had to be held down; he was so excited.

Some time ago, the school was involved in a study rather like *Your Computer's* "Design a Micro" competition — ideal for their purposes, they decided, would be a portable battery-powered, CMOS-based computer with LCD display and built-in printer. Coincidentally, Epson brought out the Epson HX-20 just as they finished, and it was pretty much what they wanted. This enables pupils to communicate and to take notes in classes.

John Piper, from Tools for Living, a Welsh-based organisation contactable on 0437-85472, pointed out that we're all one-fingered typists at heart. He showed an ergonomically-designed keyboard designed to reduce the number of repetitive moves, built by PCD Maltron Ltd.

Typing with one finger is all very well, but however fast you do it, being able to generate one word with one movement is still much faster. Clive Sinclair's Spectrum came in for some praise with its keyboard system — but you still need two fingers to operate it. A similar device for people with communication problems has been developed by Guy Hamilton, a doctor from Woking.

This is a big 2ft by 3ft pressure pad board with 800-1000 keywords written on it. The Splink, as it is known, can be hooked to a VDU via an infra-red link like a remote control TV unit. This obviates cables lying around in an environment where there are probably enough people with mobility problems anyway.

Mr Piper also demonstrated a system employing the BBC Micro to teach deaf people how to modulate the sound that comes out of their throats. Because deaf who have been deaf from birth cannot hear what they are saying, their speech may sound strange to non-handicapped people.

The BBC can be used as a source of feedback. Using a £900 Visispeech interface, an oscilloscope pattern is generated on the screen by vocal inputs. The deaf person can then try to achieve the same pattern underneath that created by the teacher.

The West Surrey Computer Club, whose secretary, Chris Karney, can be contacted on Guildford 68121 Ext 587, has many such informative evenings lined up.

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With the vast range of games now available for home computers each holds a different challenge. Now there are three Competition-Pro Joysticks in the Kempston range that will come to your aid and improve your playing capabilities. Your movements will become quicker, with finger poised over the fire button at the ready, your scores will be out of this world. Playing will be so much easier! If you're serious about the challenge your computer presents then you shouldn't be without a Kempston Competition-Pro Joystick.



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Star★ chart

Dambusters

BBC B:
Bomb it down:
£7.95:
Alligata:

★ ★ ★ ★ *Plus 5 raspberries for lack of information on availability of disc version or possibility of swapping*

Great fun and rather unpredictable version of W.W.I Dambusters exploits, Rathol simular graphics to defender (planetoid) but good and simple. Also good sound with external speakers.

Vortex

BBC B:
Shoot-'em-up:
£7.95:
Software Invasion:

★ ★ ★

This 3D in 2D game (no red and green glasses) has an inevitability about it that makes you try harder even though you know that failure looms! Unusually I found that both the joystick and keyboard gave good control of the fighter craft equipped with laser torpedoes.

Pengwyn

BBC B and Electron (see note):
Novelty:
£6.95:
Postern:

★ ★ *Plus 5 raspberries for lack of information on availability of disc version or possibility of swapping.*

Moving blocks of ice, crushing nasties and trying to align special blocks leaves me chilly.

Hicksted

Spectrum 48K:
Games for Girls':
£5.95:
CCS:

★ ★

Hicksted, is a game of computerised horsemanship based on the differently spelt show jumping ground Hickstead. It is one of three games under the somewhat dubious category of 'Games for Girls'. I thought it best if I got a little horse mad, computer crazed friend of mine to review it. She was to put it mildly disappointed. Conclusion: a great idea executed poorly.

SOFTWARE Shortlist

Snowman

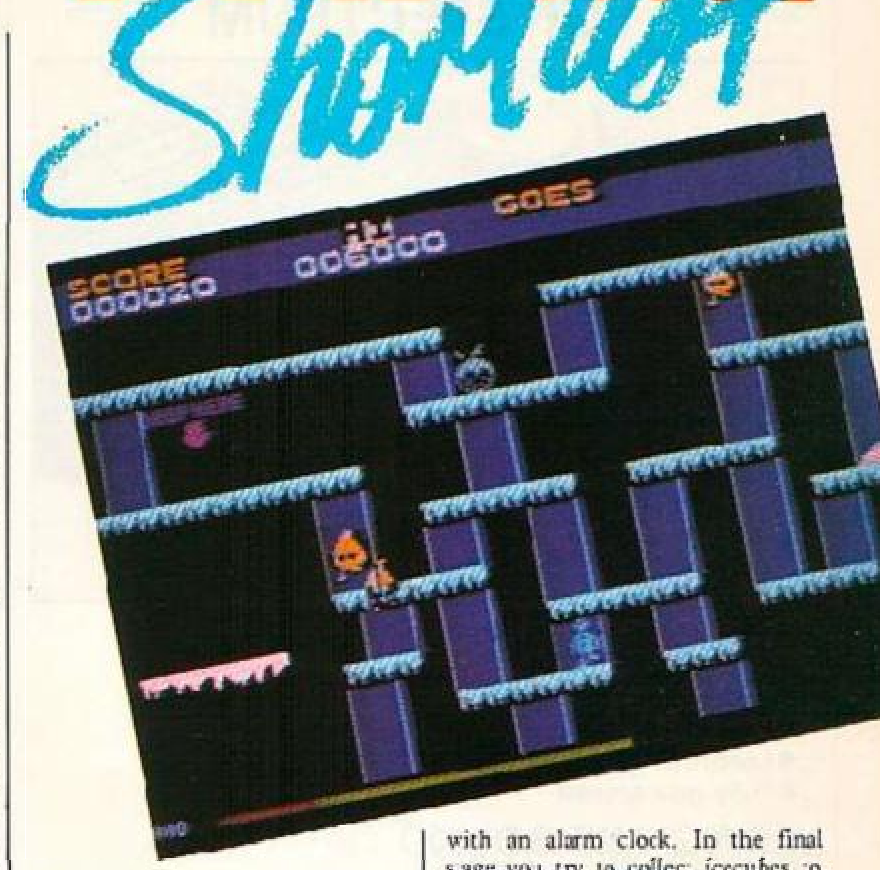
■ *Spectrum 48K*
■ *£6.95*
■ *Quicksilva*

★ ★ ★

THERE'S NO PEOPLE like snow people, and the Snowman, based on the book by Fungus the Bogeyman creator Raymond Briggs, is already noised abroad as unique among computer games for its non-violence. At last a game that parents can buy for Junior secure in the knowledge that they will not awake next morning to find their lovable offspring transformed into a bloodcrazed twitching freak.

Instead of dying in the Snowman, you go to sleep. The screen display is a frosty blue, ladders and levels display. You have to collect six pieces of snow in order to build the snowman. Watch out for roving gas flames — these melt the snow you are carrying, and it reappears elsewhere on the screen. This game will appeal to perverse people who insist on celebrating Christmas in the middle of the summer, since you gain extra points for collecting various Christmas crackers, presents, stockings and trees. If you collect an ice lolly you can ward off the gas flames. Your energy is replenished by eating a turkey or Christmas pudding.

In stages two and three you have to kit out the snowman with scarf, hat, nose etc while avoiding the Sleep Monsters. These can be neutralised with an alarm clock. In the final stage you try to collect icecubes to stop your snowman from melting. The gas flames make their comeback here. Attractive graphics, well thought-out idea, perhaps a little too much dexterity required to position your man at the bottom of ladders





Blue Thunder

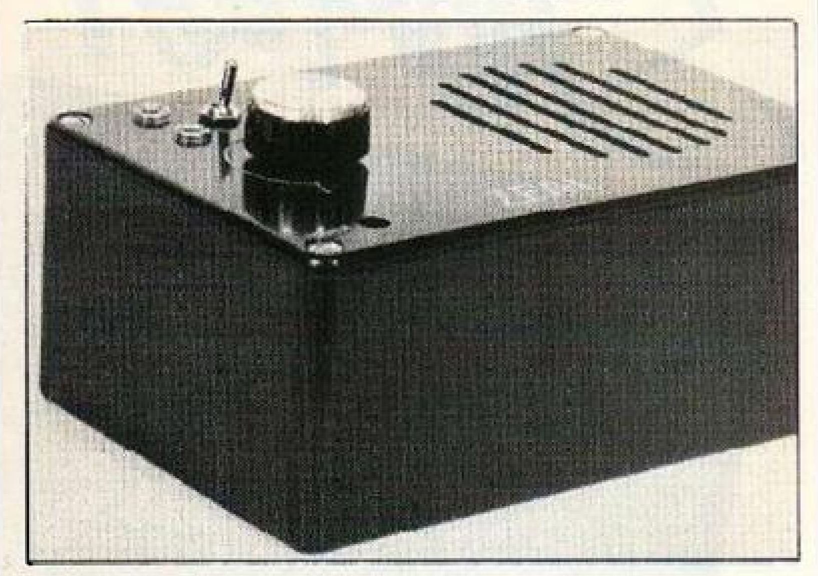
■ *Spectrum 48K*
■ *£6.95*
■ *Richard Wilcox Software*

★ ★ ★

NOTHING TO DO with the film starring Roy Scheider, or the TV series starring James Farentino; in this program we are a world away from the difficulties of community policing by helicopter. You are probably better off playing this game with a joystick, than the keyboard, but even then the fire button is given the three functions of 90, 180 degree turns and firing. This can complicate

(continued on page 59)

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DO	— DO. . .LOOP structure with WHILE, UNTIL and EXIT IF.
DPOKE	— double POKE.
EDIT	— a specified line number
ELSE	— used with IF. . .THEN.
GET	— waits for keyboard entry; doesn't use ENTER
KEYWORDS	— shifts between new keywords and normal graphics mode
ON	— GOSUB or GO TO a line number from a list of line numbers.
ON ERROR	allows trapping of most reports; has available ERROR, LINE and STAT variables.
POP	— removes data from BASIC's stack.
PROC	— named procedures, with DEF PROC and END PROC.
RENUM	— renumber part or whole program with specified start line and increment. Handles GO TO, GOSUB, ON, etc.
ROLL	— pixel movement of part or whole screen in any direction, with wrap-round.
SCROLL	— as ROLL, but without wrap-round.
SORT	— sorts part or all of string or numeric arrays according to specified substring or column. SORT INVERSE sorts in reverse order. One hundred strings can be sorted in about one fifth of a second!
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Star★chart

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★★

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Destroyer

Unexpanded Vic-20: Shoot-'em-up: Sumlock: £7.95:

★★★

An unembellished shoot-'em-up, requiring plenty of co-ordination, nevertheless. Using the keys you have to steer your destroyer back and forth on the oggin, shooting to left and right at attacking aircraft, depthcharging submarines, and dodging torpedoes and bombs. The whole game runs for a time period shown by a changing strip at the bottom of the screen. If you survive the time period, a bonus based on planes downed is added to your score. Not bad in 3K.

Bull Run

16/48K Spectrum: Run away: Phipps Associates: £6.95:

★

Silicon Pamplona. On holiday in a Spanish village you are pursued by a wild bull. There is a 30,000 pesetas reward from which 50 is deducted every second. You use yourself as bait and put up fences. These do not stay up very long. The Bull will gore you if you are carrying a fence, but you are fairly safe behind one. Three levels of play, not great graphics, cheaper than a holiday in Spain.

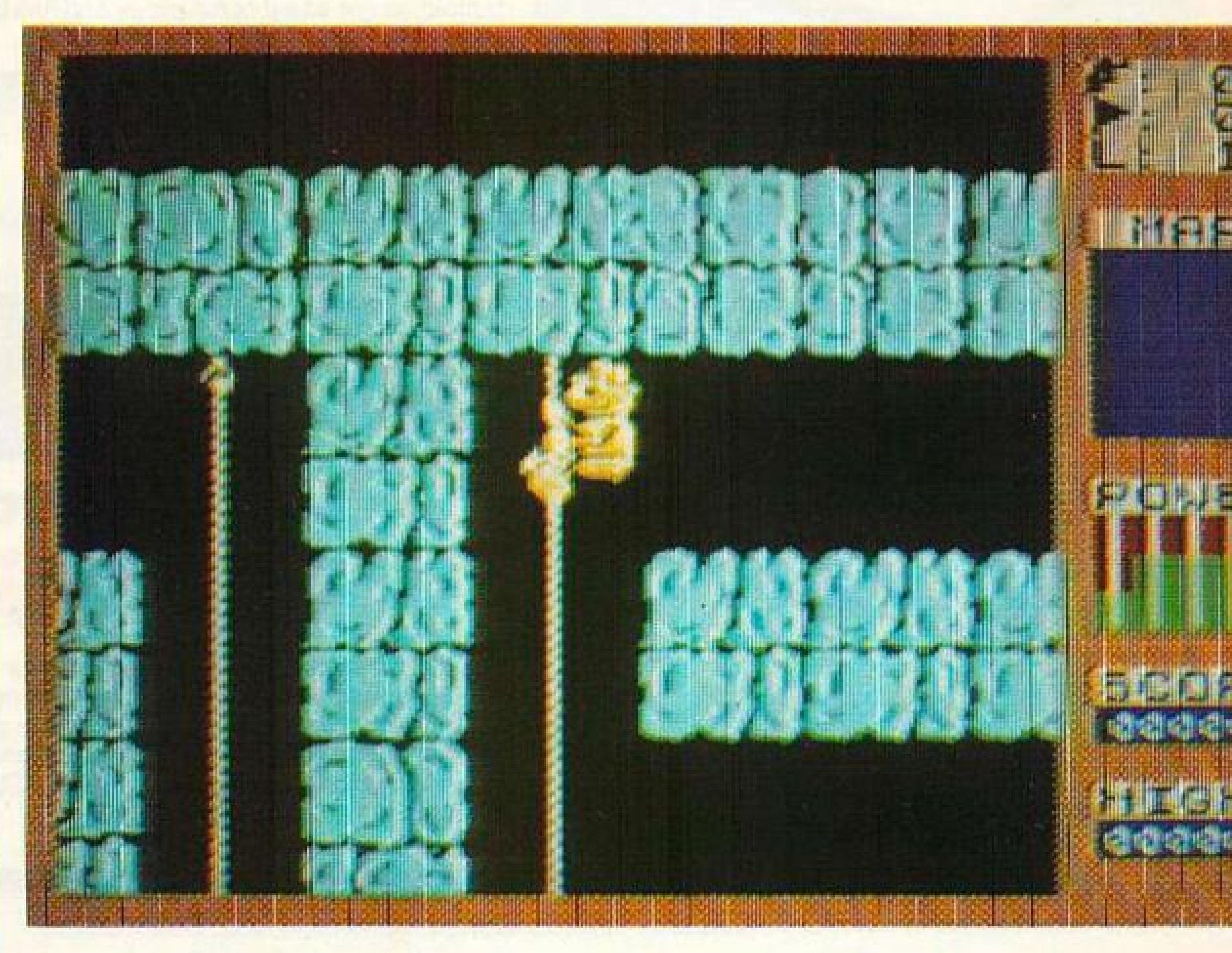
SOFTWARE Shortlist

(continued from page 57)

matters. I am also dubious about the claim of incredible perspective graphics.

This is a pretty Choplifter with a nuclear reactor thrown in. First, pilot your whirlybird off the VSTOL carrier over the islands, getting shot at. There are five different levels of difficulty. In the higher levels you contend with waves of jet fighters and indestructible red balloons. Only one of the latter at a time — the number never gets as high as 99. You penetrate enemy lines, destroy the nuclear reactor and rescue up to 16 comrades in one trip.

The on-screen score line displays from left to right, reserve etcopters, current score and mission number. A vertical bar on the right of the screen indicates your chopper's fuel level. A challenging game.



Neptune's Daughters

- Commodore CBM-64
- £7.95
- English Software

★★

As THE OLD pre-decimalisation jokes goes "My girlfriend's a mermaid — lovely vital statistics: 36,24 and four and six a pound." Your history teacher might be able to explain it to you. The aim of this game is to rescue Neptune's beautiful daughter from the sea serpent who is holding her captive. Unfortunately we have to admit this game had us pretty well stumped. It is either a very demanding and challenging game, or impossible to play and consequently stupid, depending on who you talk to.

Either way, Neptune's daughter never showed up for any of us, and it is a lot of bother fighting octopuses, sucker plants and deadly amoebae just for a blind date. You take the part of an aquaman who absorbs oxygen through his gills. You have to fight off the attentions of poisonous octopodes and clear the way of deadly sucker plants to get through to successive caverns in this Submarine Scramble scenario. You eventually encounter amoeba swarms. you have to manoeuvre yourself into a position where you can kill them with your harpoon and absorb the bubbles of oxygen which they emit as they die.

This is as far as most of us could get. Apparently after this a monster crab is encountered. You kill this and take it with you to feed the sea serpent. All being well, the gorged ophiuchan ogre will knock off for 40 winks while you depart with the girl in the wet-look outfit. You then lead her back to the safety of the palace, where presumably you can settle down to discuss the experience over half a shandy and a packet of shrimp-flavoured crisps.

This is all hearsay, however: one thing we can say — this game has a very high frustration quotient.

Fred

- 48K Spectrum
- £6.95
- Quicksilva

★★★★

FROM THE people who brought you Bugaboo or Booga-boo, depending on which computer you play it on, comes another feast of Disneyesque graphics.

The screen display presents you with a vertical maze of glowing blue stone walls, around which the intrepid Fred wends his weary way in search of the treasures of the Pharaohs. Yes, I know we have done the Pharaohs at the bottom of your garden joke.

Fred shins up and down ropes, avoiding contact with rats, acid drops, ghost which can go through walls, chameleons, mummies and vampires. He has a gun and six bullets.

There are six screens, increasing in difficulty, followed by the option to return to the first screen, or redefine the maze and number of monsters.

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$9\frac{1}{2}$" Dot-Matrix

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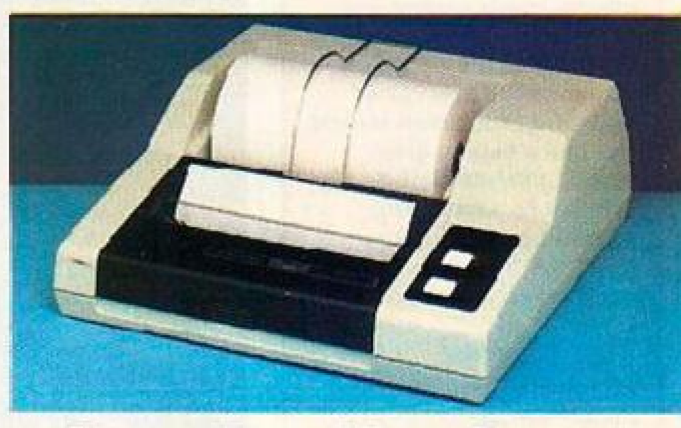
DMP-120. This versatile $9\frac{1}{2}$" dot-matrix printer has high speed data processing and graphics modes, that makes light work of many many tasks. It prints ten and 16.7 characters per inch, or elongated five and 8.3 characters per inch at up to 125 characters per second. A very compact printer it uses fanfold, single sheet or roll paper and has built in parallel and colour computer compatible serial interfaces. **26-1255**

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NEWS

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The crystal ball

Giving the crystal orb a good shake reveals two new adventures from Software Projects of Liverpool. The first, Legion, is for the BBC B and takes place at the time of the Roman Empire. McKensie is the second and has you playing the role of a famous space explorer who has been captured and imprisoned on a pirated space station. You will need a 48K Spectrum to play it.

Lothlorien, perhaps better known for its war gaming programs, has launched a series called adventure Master. The first in the series is an Arabian Nights type fantasy entitled The Stolen Lamp. It is a text and graphics adventure for BBC B owners.

Another text and full pictorial adventure for the BBC B and Commodore 64 micros is Twin Kingdom Alley, a large and complex adventure from Bug-Byte.

A helping hand

Calling all fans of Level 9 Computing's Colossal Adventure. Are you baffled by a certain bridge-blocking Troll? See below for a clue that will enable you to pass free of charge.

Attention all Scott Adams Pirate Adventurers. Could be you are stuck at the second treasure. Help is at hand below. As usual, the clues are written backwards to avoid the eyes of the unwanting unwary. Let us hear from you about other problems you are having — I will do my best to help in these pages.

Troll trouble:

RETAL MEHT EVEIRTER OT DROW CIGAM YAS: LLORT OT SGGE NEDLOG EVIG

Pirate treasure:

GID NEHT 03 ECAP,DLEIF EHT NI

Happy hunting!

QUEST Corner

Our man with the brass lamp and the key to a thousand mysteries sheds light on new adventure programs. Lost? Never fear, Hugo North is here.

Kingdom of Hamil

- BBC B
- £9.95
- Acornsoft

KINGDOM OF HAMIL is the latest puzzler to join the illustrious band of Acornsoft adventures for the BBC B Micro. This group now includes such brain bafflers as Philosopher's Quest, Sphinx Adventure, Castle of Riddles and Countdown to Doom — enough mind-bending puzzles to keep you occupied for the rest of this year.

Like the other Acornsoft adventures, Kingdom of Hamil is text only, commands being input in the normal verb and noun format. Each location is described in detail on your visit but thereafter in brief — unless you specifically request the full description with the command Look.

Some of the commands recognised by the program are detailed on the cassete box; it is up to you to find out the rest while playing.

You always wondered why you had blue blood in your veins when all your friends had common or garden red. Now you have learned why — you were stolen from your royal parents, the rulers of Hamil, as a child. It is up to you to prove your identity and claim your birthright, but watch out — you seem to have made an awful lot of enemies when you were a baby.

The adventure starts with you trapped inside a chapel. Venture outside and a 16 ton weight drops on your head, ending your assault on the throne before it has begun.

Some adventures have plenty of locations but precious little in the way of objects, dangers and puzzles. Kingdom of Hamil has them all, in spades.

Heroes of Karn

- CBM-64
- £7.00
- Interceptor Micros

HEROES OF KARN is a Commodore 64 adventure of the classic mode but in modern dress. Not only does this text-based fantasy give you an attractively drawn coloured picture of each location, it also provides some very impressive music into the bargain. As you might expect in a classic adventure, there's quite a bit of treasure needing to be collected but that is not the main purpose of your mission.

Long, long ago, a horde of fell creatures swept down upon the Land of Karn, and great was the slaughter. Few escaped the carnage but among the handful that did were four Heroes of Karn: Beren, lord of the birds of the air and swordsman supreme; Istar the Wise, master of magic and lore; Haldir, greatest of all minstrels; and Khadim the Dwarf, small in stature, mighty in renown.

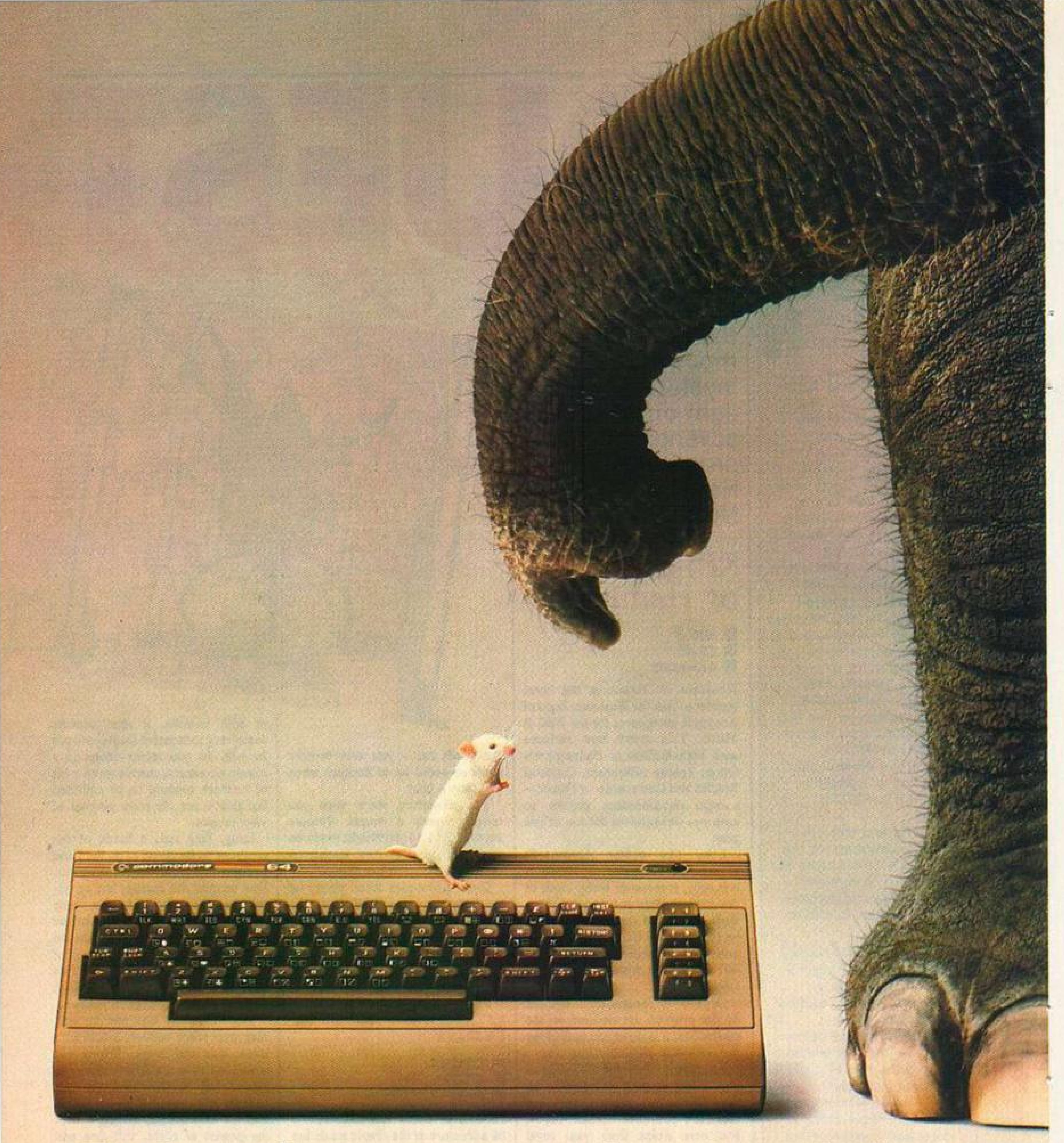
Yet, eventually and one by one, they were taken captive, bound with stone, iron and magic. Where and what they now are is unknown but legend has it that one day the stranger will come, will venture forth into the dark Lands, will fight with the powers of night, will find and release the long-imprisoned heroes.

That day has dawned — you are that stranger. Can you fulfil your destiny?

If you can, I guarantee you will not do it quickly. There are over 65 locations to seek out and explore, and over 30 puzzles to solve. Much of the adventure is linear — that is, some problems can only be solved by overcoming earlier ones. This makes it a shade tougher than some others and should give your mental powers a real workout.

Heroes of Karn is a first-rate adventure providing a great deal of pleasure. the musical passages are a delight — turn up your volume for the best effects.





The Commodore 64 is compact and nippy like many other home computers.

The Commodore 64 has an enormous memory: it's a positively elephantine 64K.

If you're unsure as to why you should want a home computer with such a big memory, we'll tell you.

It means you can use more exciting and advanced software.

This means you'll get greater enjoyment out of your home computer because you can do so much more with it.

You can create high resolution graphics, or reproduce the sounds of many different musical instruments.

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YOU CAN SEE THE COMMODORE 64 AT DIXONS, SELFRIDGES AND WALLACE HEATON AND AT MAJOR BRANCHES OF BOOTS, RUMBELOWS, WH SMITH, LASKYS, CURRYS, GREENS, ORBIT, MENZIES, MAKRO, TESCO, FINE FARE, WIGFALLS, SPECTRUM, COMET

REVIEW

After the first false dawn, Kathleen Peel finds out if real keys can help Radofin succeed where Mattel failed.

CONTINUING THE recent fashion of repackaging an existing low-price computer by fitting it with a proper keyboard, the Aquarius II succeeds the ill-fated Aquarius. At £80 it becomes the cheapest real-keyboard computer currently in production.

The misgivings regarding the original Aquarius, apart from the keyboard, were in the limited resolution of the colour display, poor Basic, virtually non-existent editing facilities, high price of peripherals and very limited software. Combined, these led to a general panning of the computer.

The revamped Aquarius competes with the Spectrum, Tandy MC-10 and Laser — the Laser may not now be on sale due to the demise of Computers for All — and fills the gap left by the discontinuation of production of the Oric 1 and the real keyboard computers, the Vic-20 and the TI-994A.

The review model is a preproduction version of the Aquarius II and there may be some minor detail changes to the finished product. As the standard of the review model is very high with a clean PCB without changes, I presume any changes will be in ROM and cosmetic.

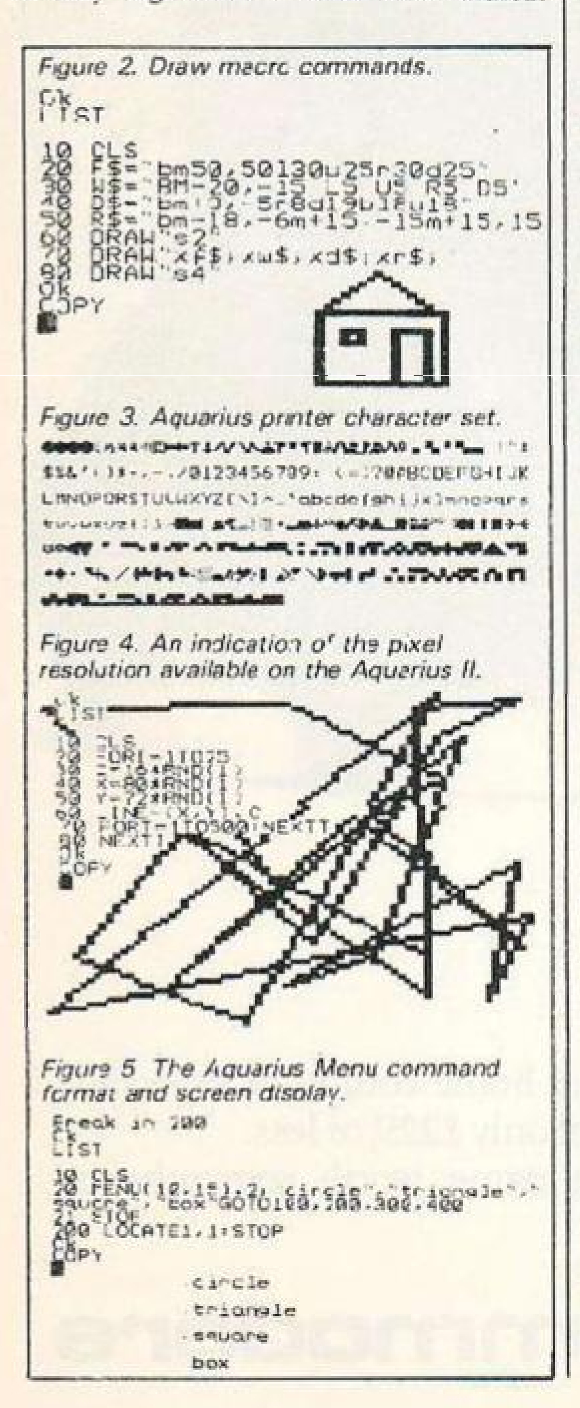


Figure 2. Draw macro commands.

Figure 3. Aquarius printer character set.

Figure 4. An indication of the pixel resolution available on the Aquarius II.

Figure 5 The Aquarius Menu command format and screen display.

The new keyboard makes a tremendous difference to the Aquarius. Although not elegantly styled, it is very good. As I like computers to have both keyword and fully typed entries, the Aquarius gets a definite plus here. My only criticism of the keyboard is that some users like an audio feedback and the computer does not provide this facility.

The Aquarius comes in a Basic 4K which leaves 1,652 bytes free for your programs — not much but a 16K RAM pack at £30 and 32K RAM pack are available.

More memory or a games cartridge can be plugged into the expansion slot. Further expansion is via a mini expander which adds two joysticks, a cartridge and a memory port and costs £40.

The Aquarius II can use the peripherals designed for the first Aquarius, and the manufacturer of these micros states that the Aquarius III, due for release in the autumn, and the Aquarius IV under development, will also be fully compatible with all peripherals and software.

The printer interface is RS-232C, but does not allow for two-way computer traffic; a pity really as it would have been useful to be able to network the Aquarius. Because the interface is RS-232, it should be possible to use any other printer providing it is capable of running at 1,200 baud.

The display was quite reasonable with little dot crawl, but surprisingly for a computer from the Far East, there is no video output.

A reset key is provided next to the on/off switch. This allows a warm start when followed by Control and C.

The Aquarius II is identical in operation to the original Aquarius with the Extended Microsoft Basic cartridge. This provides several improvements, the most significant of which is the implementation of an editor.

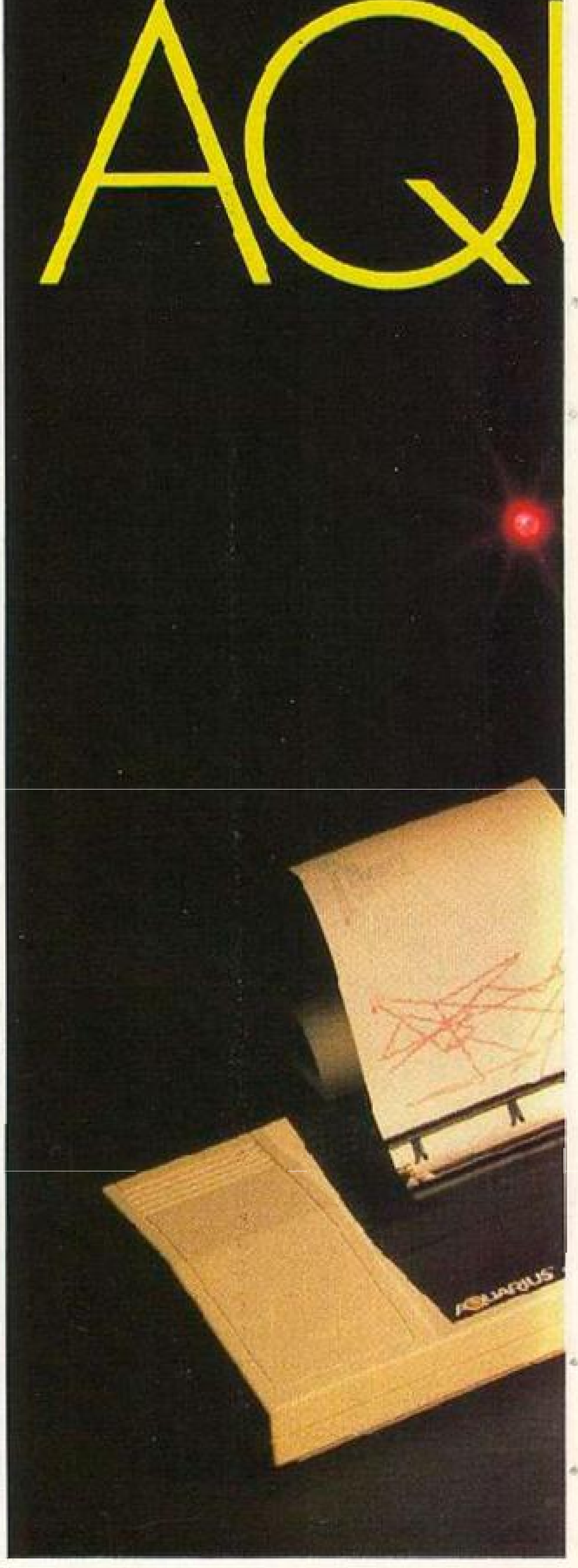
The editor has some very nice search facilities, but also some rather annoying anomalies although in use I soon became accustomed to the fact that once you have gone past a position in a line you cannot go back to edit further, you must restart the line.

The ability to search a line for the nth occurrence of a character was impressive and would have been even more so if the multi-statement lines were not limited to 72 characters.

The editor commands are:

- I insert
- X go to end of line
- L list rest of line and restart
- nD delete n characters, default 1
- H delete to end of line
- nC change n characters
- E save changes
- Q ignore changes (quit)
- A abort current changes
- nS char — search for nth occurrence
- nK char — delete n chars in line

The tape interface worked without many problems and is adequate for speed. A purpose-built tape recorder is available with built-in record and playback levels suitable for the Aquarius. But using a three- or five-way DIN with 3.5mm. plugs the Aquarius can be used with any cassette recorder.

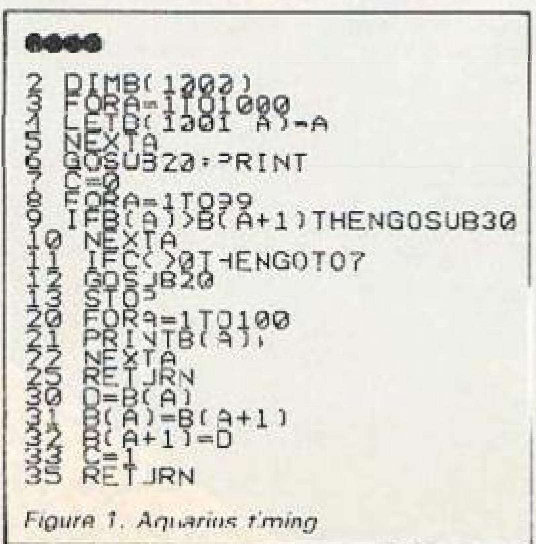


The 4K RAM is used to store the display, colour attributes and a few system variables: the user is left with 1,652 bytes for a program.

The ROM is inaccessible in normal usage. This will prevent the more adventurous user from exploring the insides of the Aquarius and can only lead to a delay in the provision of quality, independent, low-cost tape software.

The Microsoft Basic is faster than the Spectrum, timing tests are given in figure 1.

UARIUS II



```
2 DIMB(1002)
3 FORA=1TO1000
4 LETB(1001 A)-A
5 NEXTA
6 GOSUB20:PRINT
7 C=0
8 FORA=1TO99
9 IFB(A)>B(A+1)THENGOSUB30
10 NEXTA
11 IFC<>0THENGOTO7
12 GOSUB20
13 STOP
20 FORA=1TO100
21 PRINTB(A);
22 NEXTA
25 RETURN
30 D=B(A)
31 B(A)=B(A+1)
32 B(A+1)=D
33 C=1
35 RETURN
```

Figure 1. Aquarius timing

As is usual in computers of this price, the Basic lacks good structure and only supports On Gosub and On Goto.

The Basic is not space-sensitive and tidies up messy input nicely and treats upper- and lower-case the same. Unfortunately, error messages are of the two-letter variety and are not always that helpful to the uninitiated.

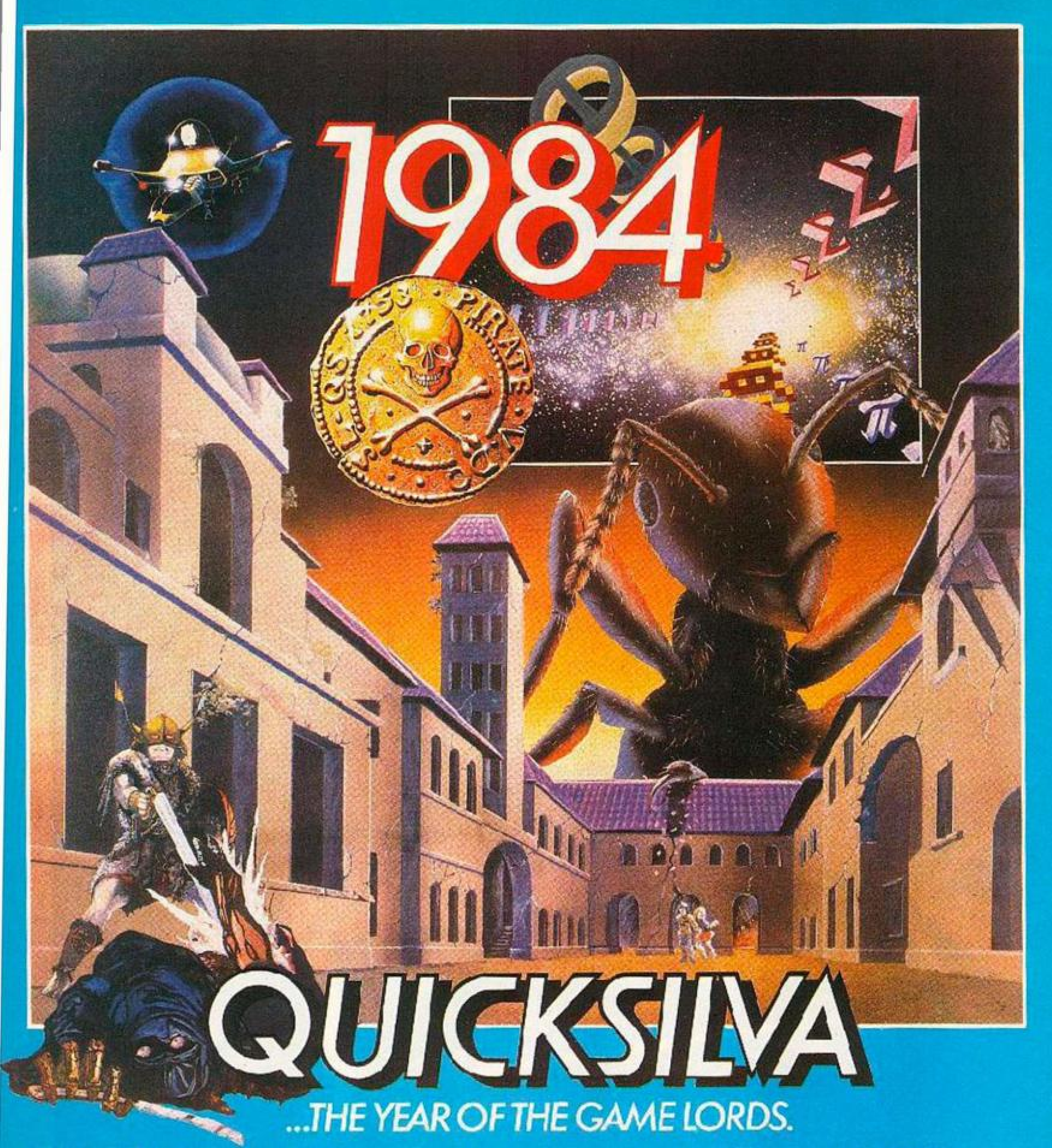
Program lines are compressed in memory. The speed test program used 227 bytes in program storage, and Spectrum used 339 for the same program, thus the small memory is worth about 2.2K in Spectrum terms. Note that as a consequence of the packaging, numerical accuracy is not so good.

The Aquarius Extended Microsoft Basic can use the Def FN command to define user-specified functions. These act as small programs within the Basic program and when given an argument will produce a numeric answer. SQR is a built-in Def and given the argument 49 would produce the answer 7.

Line and Circle commands are available which can be extended to cover colour, fill and boxing using additional parameters. Interestingly there is a sub-set of the MSX Draw Macro commands. Figure 2 gives a screen dump of an example from the manual showing the macro commands in use, drawing a little house.

The Aquarius II has a screen resolution of 80 by 72 using the teletext-type three-by-two graphics blocks — figure 4. The Aquarius

(continued on page 67)



...THE YEAR OF THE GAME LORDS.

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Bertie Bee needs help defending the hive. Fight off the invading swarms, battle the bees and defend your Queen!

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Itchy action!
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SEND S.A.E. FOR FULL COLOUR CATALOGUE

(continued from page 65)

claim of a 320 by 192 graphics resolution simply means that 320 is the number of pixels across the screen and that there are 192 down. They are not individually addressable.

The colour resolution is equivalent to 40 by 48 or 80 by 24 depending upon which way you wish to use the teletext graphics.

Two other useful commands are Get and Put. These sprite-like commands copy to and write from a specified array, producing high-speed animation — it is quicker than Peek and Poke.

Menu is a command I have not seen before. It permits a selection of items to be placed on the screen and the cursor used to make a choice from the menu — figure 5. This looked to be more than just a novelty.

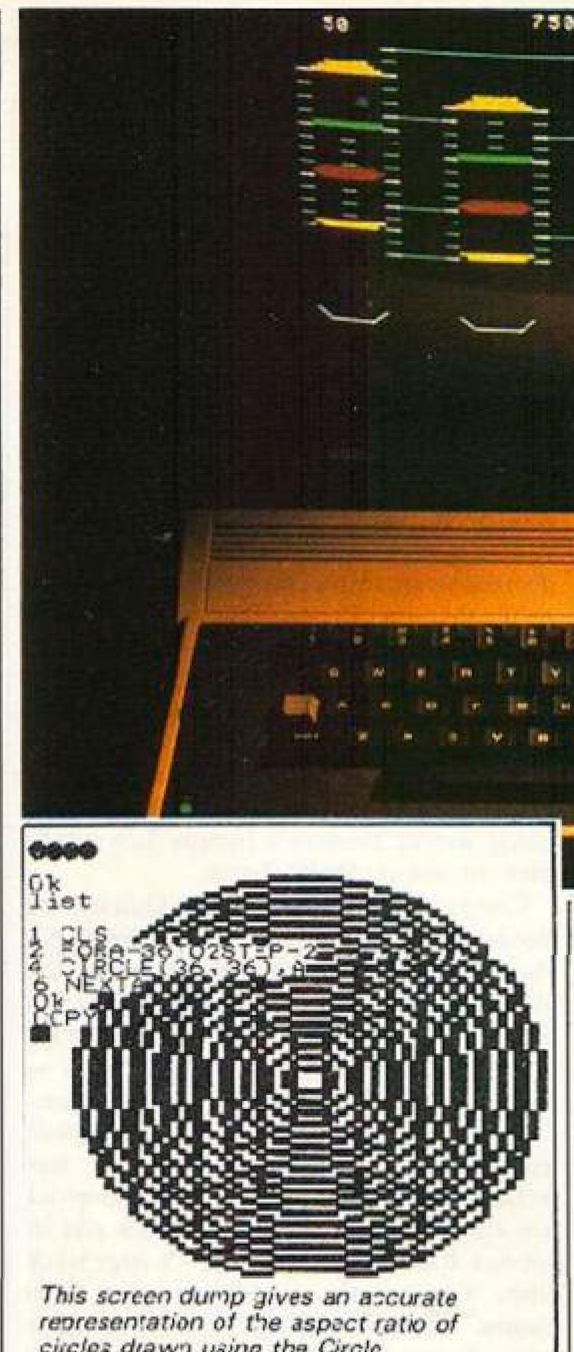
There was very little documentation regarding the sound capabilities of the Aquarius II. It appeared to be a single channel operating through the television speaker. The games cartridges supplied with the review model showed the sound to be superior to the Spectrum.

It can be seen from the screen copies that the circle command does not produce round circles. This can be corrected by using the aspect parameter of the circle command.

A new variation of the popular four-colour printer plotter is to be launched with this computer. The printer has all the normal printing and plotting facilities of the originally released Tandy model and costs £120.

- The differences are:
- There is no Centronics interface.
- The whole of the Aquarius character set is built into the printer.
- The printer can produce single colour screen dumps using the Copy command.
- The transmission rate at 1,200 baud is twice the speed of the Tandy.

I managed to hook the printer up to a Spectrum through the Interface 1 without difficulty. The graphic characters are obviously different but using the full-colour screen dump programs I have produced in the Microdrive articles, this should not be a problem.



This screen dump gives an accurate representation of the aspect ratio of circles drawn using the Circle commands.

There appears to be a bug in the Aquarius Copy command which sometimes gives an offset of half a character out of position on mixed graphics and text use.

The accuracy of the reproduction is very much better than that of the Aquarius Thermal Printer at £99.

General control of the colour printer is by:

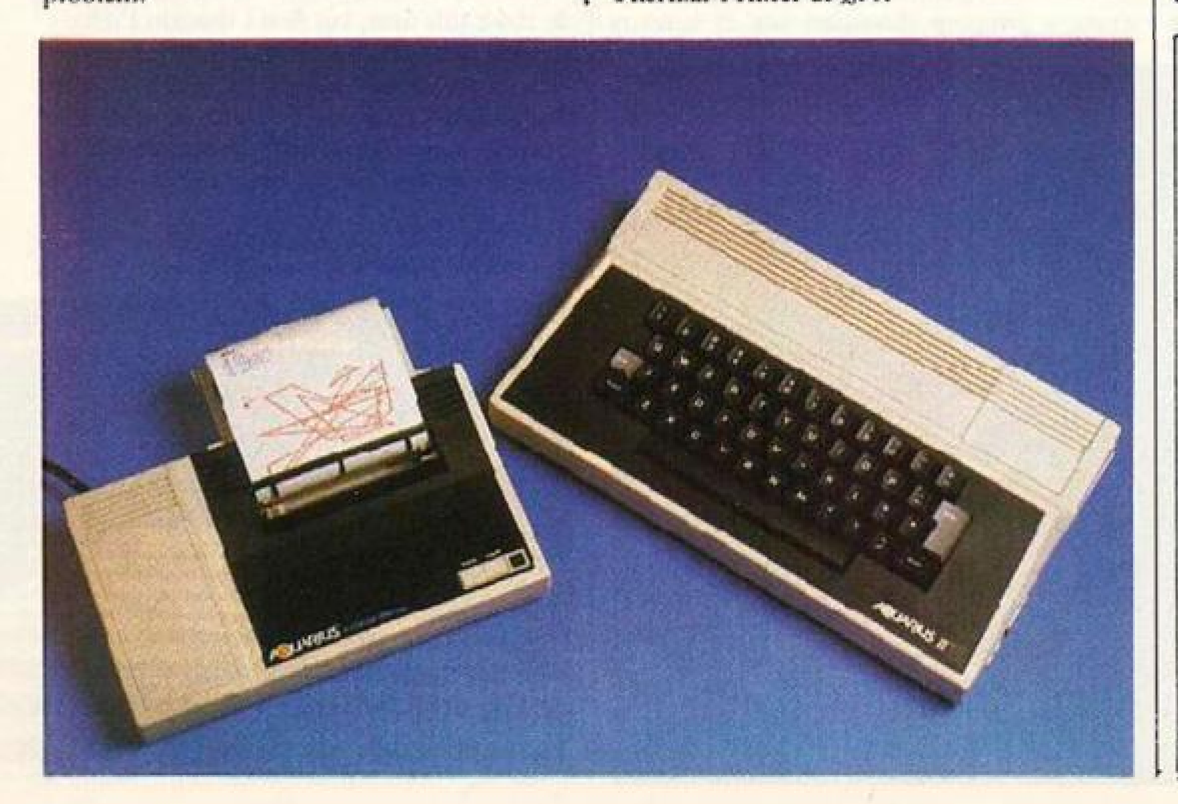
- Text; LPrint; LList the only way to use the plotting facilities.
- Mixed; LPrint; LList graphic characters available but fewer control codes.
- Graphics; Copy for screen dumps.

The technical specification for the printer is:

RS-232C with Data and CTS
Eight bit character
One start bit
One stop bit
No parity
1,200 baud

The provisional documentation appears to be very detailed with a number of useful examples to get the user started.

Because the review model was a preproduction version of the Aquarius it did not have any documentation specific to it. Neither the computer or the printer are completely new products and therefore documentation should be good.



CONCLUSIONS

- The concept of compatibility through the Aquarius range is good and probably worth a premium. The software, comparitively speaking, is limited in both volume, quality and is also expensive, but is available. I think the peripherals could be more aggressively priced and every effort must be made to ensure users are not restricted in accessing information on the technical aspects of the Aquarius.
- At £80, a games machine well worth considering and a vast improvement over the Aquarius 1.
- It is expected that disc drives will be available in April or May but at present there is no indication of price.

CBM-64 SOFTWARE

Paul Bond flees with fleas and races in space.

WE WELCOME our new president. Our country of Ananaba should prosper under your supreme excellency's care. With such celutions of grandeur we commence this survey of some of the recent games software which has become available for the Commodore CBM-64, the computer you automatically associate with elephants.

Banana Drama proves conclusively that it ain't what you do, it's the way that you do it. Part of a batch of what might loosely be termed "simulations" from Visions Software Factory, the program puts you shaking into the shoes of Juan Rodrigues LVII. This tinpot dictator has to remain in power by skillful manipulation of public opinion and careful financial management.

Graphics are limited

Graphics are limited to colour presentations of status reports, financial analyses, and news-flashes. Your supreme excellency is sometimes, for example, asked by the industrialists to make trade union activities illegal. If you do, you will enhance your popularity with the dreaded State Security Organisation. Ananaba obviously sorted out any problems with its equivalent of GCHQ Cheltenham years ago.

Once you have decided whether or not to infringe people's democratic rights, the program presents you with a number of options. You can please foreign powers, pacify a sector, assist a sector, raise state funds, do nothing or look after number one. You can buy a private submarine, for example. You can also improve your status, but this is almost as expensive as hiring an advertising agency as some governments have been known to do.

Gusher is also from Visions. Your chance to wear a 10-gallon hat and sit in front of the computer grinning and saying "Have a nice day, y'all; getcha later". This Dallas scenario has you drilling for oil, transporting it by road, or building pipelines. You can export it by tanker or supertanker, but there is no Straits of Hormuz hazard.

A good map display shows your road tanker crawling to its destination, or your ship coming in. There are random well-based disasters, pipelines valve failures, and wage demands from ship's personnel. The aim is to be the first out of two to four players to earn one million dollars from the exporting of oil. Until then all your revenue is pounds. Maybe there's something to those New Forest oil deposits after all.

Insects are attracted to the Commodore 64 for some reason, although the only real bug I found was in Sumlock's Jumpin Jack which gave an out-of-memory error.

Creepy-crawlies abound in Quicksilva's Boogaboo — a close relative of Bugaboo for the Spectrum. That program was written by Paco and Paco and a whole host of Spanish types. Pedro Ruiz takes a bit of the credit for the 64 version, along with Felix Arrabas — music — and J L Dominguez — production.

Sting 64, another exercise in computerised entomology from Quicksilva, was less attractive. The idea is good, but the graphics are rather clumsy. Screen One puts you in joystick control of a bee-swarm — a large black blob. You use this to bounce other blob-swarms which are trying to take over your hives. Screen Two puts you in defence of an individual hive; and fly a squadron of stripey stingers into the encroaching hordes. When your bees are all dead you can swoop back to the hive and pick up another lot until the hive is taken over. The final scene leaves you defending a rather repulsive looking organism, from attacking drones.

From bees to ants. Hideous Bill and the Gigants, a gripping three-part tale of heroism and romance, is one of Virgin Games' more promising efforts. Bill — we are assured that the nickname Hideous was bestowed upon him by his father out of simple but accurate malice — must save Greta, the light of his life, from becoming ant food.

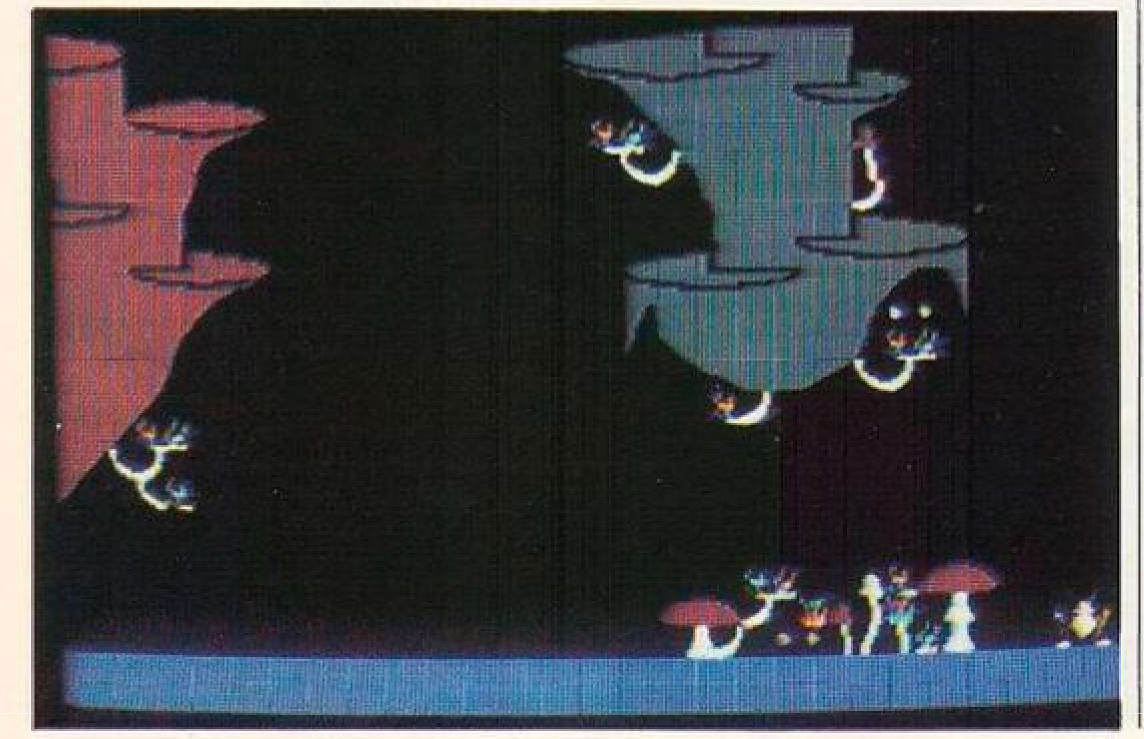
You propel Bill around a Pac-Manesque maze crushing ant-eggs, pursued by the aggrieved parents. Grab a spear and you can kill the soldier ants, but only for a set period of time. The pink ant seems particularly nasty, but *Your Computer* would not wish to be accused of singling out pink monsters for critical attention. Any reference to the peculiar aggressiveness of these creatues is based solely on detached observation. You have been warned.

You get no weapons

On the second screen you get no weapons; you run around the maze, squashing baby insects, presumably infants. To trap the Gigants you pick up a lever, insert it in a mechanism and use it to open and close the doors in the maze-centre. Pretty convoluted, huh? There is a tin of baked beans in the centre: you need this to get through the third level, where you tunnel down through underground workings, while the eggs are hatching, to free Greta. Then you get a surprise. This game is definitely value for money.

Spiders also get a look in, in Bubble Bus's Widow's Revenge. Arachnophobes beware. This is one of those scenarious where internecine violence in the back garden has escalated to a previously unacceptable level. Using a laser base, mobile within the bottom third of the screen, you must neutralise various ants and spiders. There is an impressive bird which whoops when you hit it and shoots up the screen. It is Centipede without the centipede. Fast and furious and quite addictive.

The depths of space are beckoning as they do about this time, but first I thought I'd have a quick game of table football before zooming off into the lonely cosmos. Of course Bubble Bus's Kick-off doesn't compare with the Chromasonics 3D football game, neither is there an option for grabbing one side of the



Left: Bugaboo from Quicksilva.
Below: Megahawk from Big C.



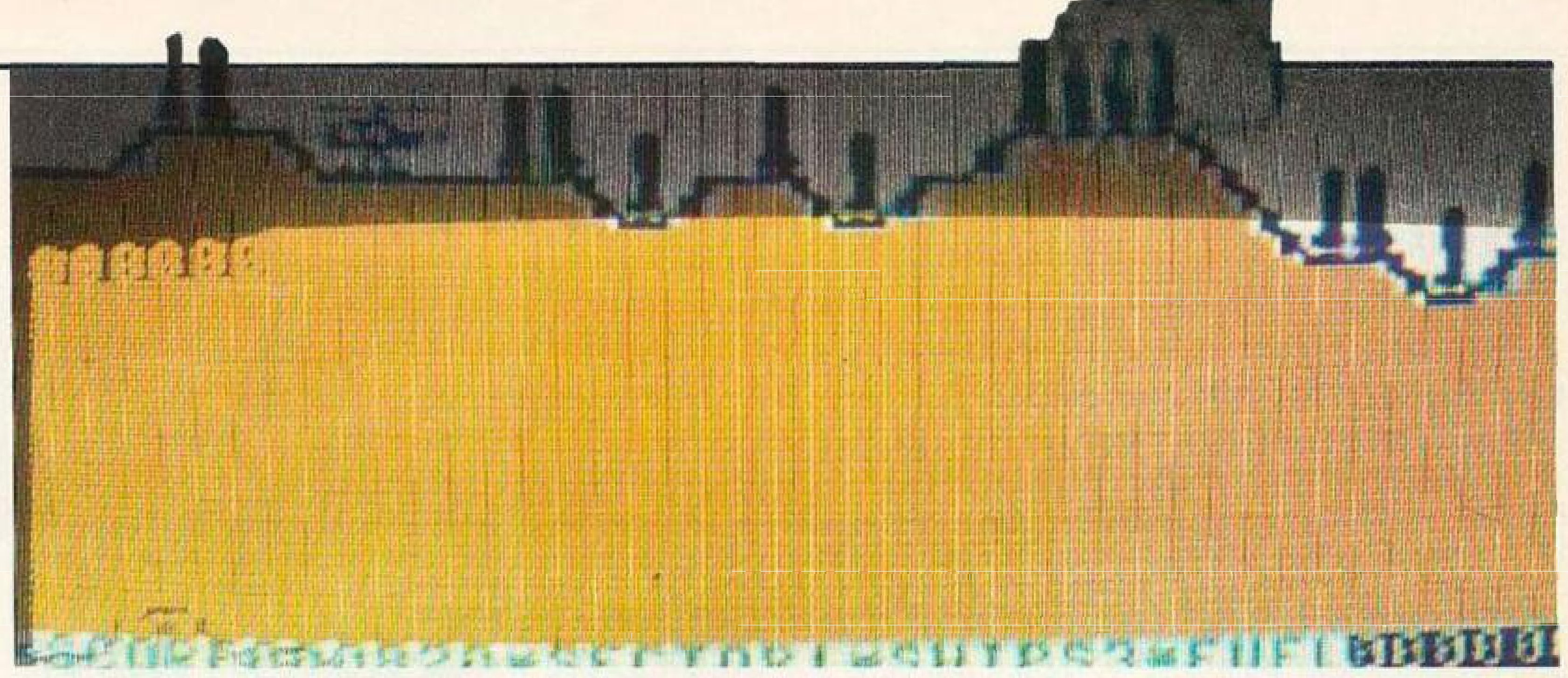


table and making sure the ball rolls down the opposite end.

Right, here we go. Zooming down the fearsome space tunnel, the first of Hagon's many sophisticated defence systems, every fibre of my being is filled with dread. The Hagon fleet has been alerted and wave after wave of astro-fighters comes hurtling at me. The fate of entire galaxy et cetera rests on the success of my mission. You know how it is. Quasar from Voyager is actually rather good; you fly down a valley with mountains on either side. Above you stars twinkle in the airless reaches of the void. The approaching craft cast shadows, giving a realistic 3D effect. Your craft can bank and swerve to avoid them. When you have knocked out these — the more skilfully you knock them out the faster you progress to the next level — you are confronted by bouncing robots. These don't cast shadows. Having dispensed with the springy cybernauts you are flying through space with asteroids, space mines and Etron rockets as they flash towards you. Next you face scene one again, but with indestructible defence poles added — you have to fly around these.

Megahawk from Big G is startlingly similar, except that the corridor sequence has a roof on it, and that both you and the approaching aliens have flapping wings. Refinements include a gauge showing how much longer you have to survive in each sector. My vote goes to the kangaroo dinosaurs that suddenly appear hopping across the planetary plain in this program.

Hopping is one way of travelling in Anirog's Moon Buggy. Piloting your balloon-wheeled personnel carrier across the stark lunar landscape, rocket motors help you spring across chasms and a ray-gun disintegrates the groke-like orange blobs sitting around with a singular disregard for the highway code. Apart from the gelatinous jay-walkers, your joy-ride is impeded by the activities of what looks suspiciously like a helicopter dropping bombs on you. Of course, everyone knows that it's impossible to have helicopters on our moon; and likewise this game is practically impossible to play. Any lunar motorist who lives longer than 25 seconds is a veteran.

Anirog Skramble pitches you into the familiar red landscape, dotted with anti-aircraft missiles and fuel dumps which you

Above: Super Skramble from Terminal Software. Right: Skremble from Anirog.

have to bomb to keep yourself flying. This is followed by a blue landscape leading into the traditional tunnel with its irritating whizzers. You can shoot these but in the next zone you are confronted by indestructible fireballs over a brown landscape; it is a competent implementation and quite good fun to play.

Terminal's Super Skramble is a little more daunting. There is a distinct fuel consumption problem. You really do have to wreak havoc in every single fuel depot or you just won't stay off the ground long enough to enter the cavern.

In PSS's Neoclyps you are the good guy, freedom fighter and renowned star pilot. The bad guys, an alien race from a distant solar system have invaded Neoclyps, one of your colonial planets.

Destroy the radar towers

The aim of the game is to destroy the alien radar towers and shoot down the defence craft. You start off with 12 ships and lose one each time you crash into an aliens, a radar tower or the planet itself. Every time you down one of the bad guys, you get an energy shield which means you can move through solid objects — you can dive down through the city structures and into the planet's surface itself.

Stellar Dodger from Terminal Software plunges us into another other-wordly scenario unlikely to encourage tourism. As an inter-stellar shuttle pilot you provide the vital link between your starcruiser mothership and the planetary supply dumps. In the way is a treacherous asteroid belt. The screen display shows the carrier, from which you detach your spherical lander. It even has little flashing lights around its equator — by pressing the fire button on the joystick. Dodge the rocks and land on one of the three blastpads at the bottom of the screen.

The game can be played with the keyboard as well as with joystick, but I don't feel myself quite in accord with the effusive blurb on the packaging. Superb hi-res flicker-free sprite graphics? Superb, they ain't. Just plain ordinary. Full colour? Maybe, but the things on the screen are so small they look mostly white. Great sound effects? I should jolly well hope so.



Company	Game	Price
Visions Software Factory, 1 Felgate Mews, Studland St, London W6 9JT	Gusher Banana Drama	£9.95 £9.95
Quicksilva, Palmerston Park House, 13 Palmerston Rd, Southampton SO1 1LL	Sting 64 Booga-boo	£7.95 £7.95
Virgin Games, 61-63 Portobello Rd, London W11 3DD	Hideous Bill and the Gi-gants	£7.95
Bubble Bus, 87 High St, Tonbridge, Kent TN9 1RX	Kick-off Widow's Revenge	£6.99 £6.99
Anirog Software, 8 High St, Horley, Surrey	Moon Buggy Skramble	£7.95
Terminal Software, 28 Church Lane, Prestwich, Manchester.	Super Skramble Stellar Doger	£7.75 £7.75
PSS, 452 Stoney Stanton Road, Coventry	Neoclyps Cosmic Split	£7.95 £7.95
Big G, Bircmoss Hall, Haverton, Nantwich, Cheshire	Megahawk	£6.95
Voyager, The Business Centre, Claughton Road, Birkenhead L41 6ES	Quasar	£5.99

DRAGON SURVEY SOFTWARE

From a quiet day fishing on the riverbank to zooming through hostile space zones, Paul Bond discovers the Dragon has it all.

IF THERE IS one thing the Dragon has been blessed with in abundance by the software companies, it is adventure games. Another popular theme, for some reason, appears to be Kong-style games. So if you are into swords and sorcery, dungeons and dragons, and a certain amount of running up and down ladders evading the wrath of apes/droids/icky things, then the Dragon has it all.

Monsters from Softek Software is a prime example of the latter genre. Your spacecraft lands on the surface of Zol II, which as luck would have it is a veritable Swiss cheese of ladders and platforms patrolled by bellicose monster-robots. You have to find a power module in each mine and return it to your ship before your air supply runs out and you succumb to anoxia.

On-screen this gripping scenario is reduced to the usual grid of vertical ladders and horizontal platforms depicted from a side-view in the traditional autumnal Dragon colours of green, brown and yellow. The ladders are always yellow. It is tempting to conclude that the Dragon's home environment of bosky hillsides, verdant valleys and fertile sylvan glades has exercised some strange atavistic influence on the Welsh micro's colour-set. The result may be restful, but when looking at a batch of Dragon software one is left with a craving for a splash of colour, perhaps the torrid crimson of the heraldic dragon of Cymru itself.

If you succeed in your task by dexterous use of the cursor keys to move the Shift keys to dig, you can penetrate further into the alien delvings and encounter monster-robots who have actually found out how to climb ladders and give you quite a hard time. The computer games fall into certain generic types is undeniable. This is a competent implementation of the digging-holes-for-monsters-to-fall-through type.

Bonka is another variation on the same theme. This scenario from J Morrison Micros thrusts a man wearing a bowler hat and carrying a space-hammer in among a bunch of homicidal, highly-charged Blue Meanies. This is closer to the arcade ancestor, except that the Meanies do not wave their antennae about, but the idea is to lure them into holes dug with the trusty space hammer and bonk them on the head.

The worst example

There are four different ladder layouts, four selectable speeds and option of one to nine Meanies to start with. More points are added for the more levels the Meanie falls — the idea is try and dig holes from the top level down to the bottom. Of course your oxygen supply is running out. This would get my vote, if only for the fact that the Meanies are blue. The ladders remain stolidly yellow.

Fireball, from Abacus Software, is the worst example of the Kong tendency. You cannot even get the man up the ladders. The company, who should not be confused with Abacus Programs, are hard to contact, so I could not deduce if this bug was solely due to incomplete documentation. Why it is called Fireball is a complete mystery. You are on the bottom level being assailed by half-sentient purple jellies. Apparently if you hit the fire-button this will help you in and out of lifts. Sadly there are no lifts in this particular program.

There are, of course, shoot-'em-ups for the Dragon, but most of the ones tested for this review remained relatively restful. Microdeal's Skramble sticks close to the standard Scramble format, although you probably would never have guessed this from the ingeniously original name. You zoom over mountains, bombing fuel dumps, braving anti-aircraft fire and shooting down missiles.

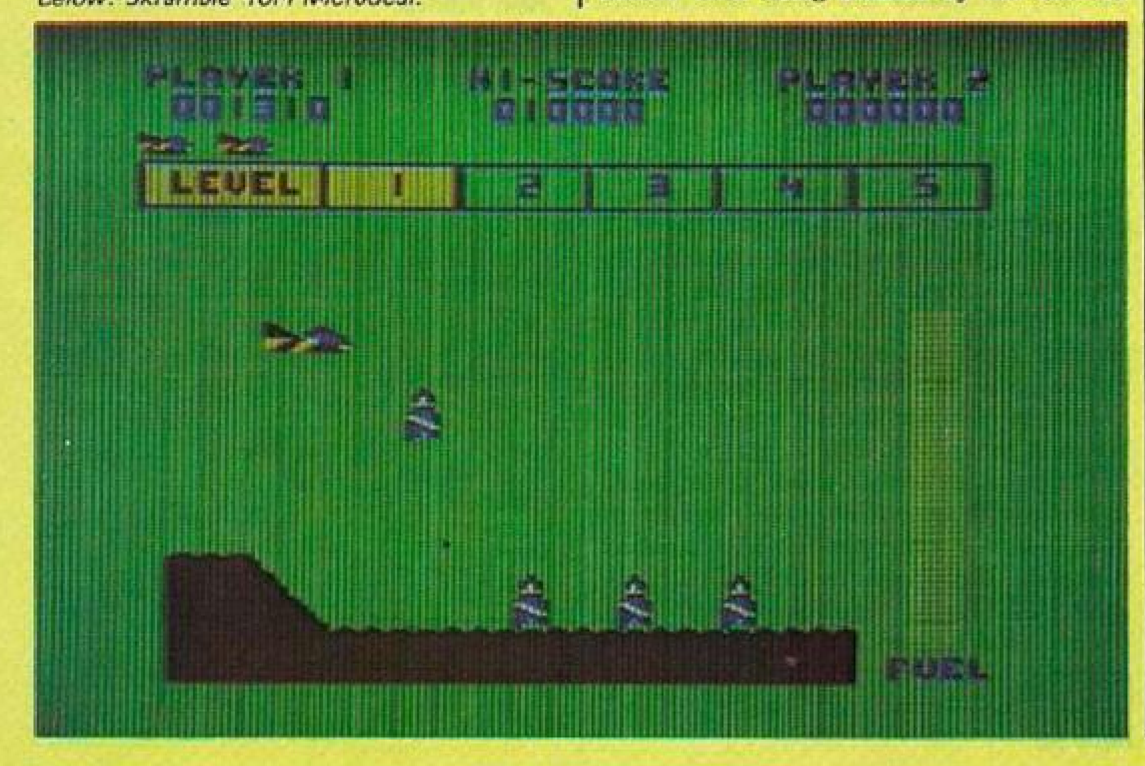
Dragonhawk from Microdeal presents us with an unedifying scenario of larvae and flies littering the screen. You have to shoot all the flies but avoid hitting the larvae because they turn into birds. The Nuffield biology course really has a lot of things to answer for.

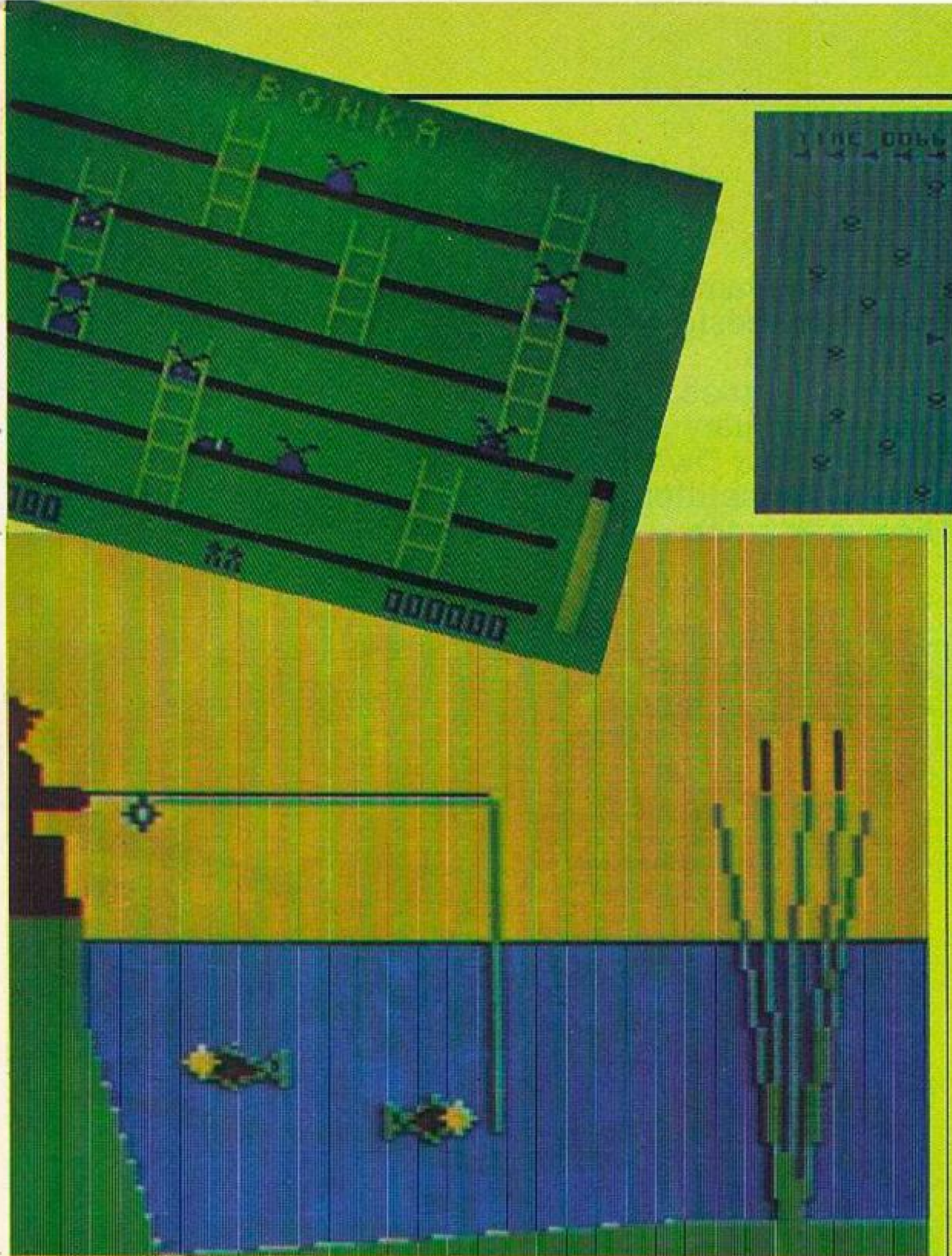
The problem with the birds is that they hamper your movement somewhat by blowing up every time you bump into them, and they tend to spend a lot of time lying around on the ground. You are supposed to be saving the unfortunate Fred from being collared by a Dragonhawk which flaps ponderously across the top of the screen, hiding behind a brown shield. You can shoot the bird, provided you do not trip over one of the fissile avians dust-bathing to the base of the screen, but you really only get two opportunities to do it. If you shoot it after Fred has been seized in its claws then you have to catch him in a tray, of course. The whole thing has the perverse logic of dream except of course that dreams usually have a higher resolution and are much more colourful.

Being the adventurer you are and having survived all the previous adventures you have attempted, you still went out and bought Microdeal's Ultimate Adventure 4. This is, we are assured, an adventure game with a difference. You are obviously over qualified for any more expeditions of the dungeons, haunted houses, space trek type. So here we have a game which is totally new, that is, it has all the elements just mentioned thrown in together.

You begin with £250 in the market place. You have to buy gear ranging from spacesuits to shovels to assist you in your quest. Your goal is to accumulate £1,000. Common problems are encountered: each move diminishes your initial 250 strength units. Most is lost in encounters. Your survival depends on using the right item for the right fight, but you can only carry up to eight objects, including treasure. There are seven treasures to be collect.

Below: Skramble from Microdeal.





Above left: Bonka from J. Morrison Micros. Above: Avenger from Voyager Software. Left: Hooked from Shards.

The difference here is the portholes which link the various parts of the adventure together. You can be wandering down a dune and suddenly get zapped into a jungle, or somewhere even more outlandish.

A fishing rod might have been of some use to me in my travels — however I had plenty of opportunity to build up that resource which the "compleat" angler requires more than any other. Patience. The screen display for Shards' Hooked depicts a brother of the angler sitting hunched on the riverbank clutching a telescopic rod guaranteed to make Izaak Walton green with envy. As no man is born an artist, so no man is born an angler, as the great fisherman used to say; this simulation did nothing to convert me, but I would hazard that it replicates faithfully the boredom of the actual pastime with none of the disadvantages of contracting arthritis or killing swans by poisoning them with lead weights.

This is the sort of game that might come in useful for people recuperating from the effecs of prolonged space combat such as we experience in Avenger, by Voyager Software. This has a rather peculiar loading protocol, not well explained in the documentation — I had to mess about a bit to get the machine code in. Screen 1 presents you with a number of green objects — munitions stores — which you have to land on without bumping into the orange cross-shaped mines.

Each landing gains you 10 shots in the second stage of the game where you are catapulted headlong into an advancing swarm of actually rather inoffensive aliens. They do not shoot at you. You, however can butcher them mercilessly — if it moves blast it as they say on the more bloodcrazed blurbs. Each hit scores five points. If you get as far as the third screen, you have to try and attain the top of it in the time allowed.

You have a fly through a couple of asteroid belts however and if you hang around too long waiting for a gap a missile will be launched these missiles never miss. Each level has its own high score table.

Illusions of speed

Devil Assault, another Microdeal game, this time by well-known software cowboy Tom Mix, shows the kind of illusion of speed that can be generated on the D32. As in the previous game you can select the colour of the background you wish to play on. There are six skill levels. These determine the starting level and the type of missile fired.

At the beginning of each screen the alien antagonists materialise by having their component parts appear to rush together from each side of the screen, accompanied by an impressive whooshing sound.

Vampire bats fly back and forth across the first screen, while the lowest one tracks you and tries to bomb you *a la* Galaxians. Should you manage to hit one of these creatures they split in two — if it is one of the lowermost pair the rest of the flock come swooping down at your laser base. At higher levels, the devil himself appears running across the top of the screen and dropping a flaming cauldron which severely hampers your movement. And this is not all — presently you have to put up with crazed robots on the second screen, and last but definitely not least, the belligerent sproings — purple blobs which bounce about trying to stomp on your base.

Company	Program	Price
Softek 12/13 Henrietta Street, London WC2 8LH	Monsters	£6.95
Voyager Software Business Centre Claughton Road Birkenhead, Merseyside L41 6ES	Avenger	£5.99
J Morrison Micros 2 Glensdale St Leeds LS9 9JJ.	Bonka	£7.95
Microdeal 41 Truro Rd St Austell Cornwall PL25 5JE	Skramble Ultimate Adventure 4 Dragonhawk	£8.00

DESIGN YOUR OWN MICRO

Everyone wants to be a computer designer now, as the flood of entries for our January Design Your Own Micro competition shows. Meirion Jones reports on the ideas that appealed to our independent team of experts. Next month — what the computer companies think.

WAKE UP Clive Sinclair, and Commodore and Acorn too. So far Aphrodite, Da Vinci, Invincible, Mandarin and the rest have just been project code names in the *Your Computer* vaults. Now we can reveal the plans our readers have for putting better micros at their fingertips — and there are more would-be computer designers out there than you ever imagined.

Ideas ranged from a go-anywhere portable with a built-in radio telephone to a latter-day Nascom hobby computer. Entries came in from all over the world including an IBM lookalike from Angola and a Bang & Olufsen hi-fi style design from Denmark.

Some readers put in more work than others. While half a dozen people sent in sketches on the backs of envelopes other covered pages of graph paper with circuit diagrams and Peter Au-Yeung sent in an 8,000 word typed submission outlining his ideas.

The overwhelming majority of the entrants took the competition very seriously — except, that is for Matthew May of Dublin. His Perfect Micro would have a robot arm for typing in programs, not to mention robotic legs, an acoustic Modem to give you access to "everything from Ceefax to Nato" and a list of languages including Basic, Pascal, Fortran, Rude, Assembler, French, Logo, Pogo, Pretty Basic, Very Basic, Forth, Second, Noddy, and Big Ears.

A surprising number of the entries in all categories were improvements on the Spectrum. The most popular idea was to give it a proper typewriter keyboard, with function keys better sound, cartridge and joystick interfaces and a built-in cassette recorder to tidy up loading. You could tell that the dreaded ZX-81 RAMpack wobble problem had burnt its way indelibly into some of the designers' minds. They had drawn agricultural-looking bolt on peripherals which would not have come adrift in a nuclear war let alone if someone jogged the table when you were programming.

Sinclair's QL was announced before the competition closed — in time to affect some of the later entries. One design was just a rough sketch of a QL in the attache case, sawn off at the end of the keyboard so that the twin Microdrives could be fitted in by being turned through 90° and fitted above the keyboard next to a flat screen TV.

Like Apple's Macintosh, also announced in January, the QL has one of the 68000 family of processors at its core so it was no surprise that the last few mailbags of designs were full of 68000-based machines. Overall most readers went for the 8-bit central processors they know and love — 6502s if they were Commodore, Oric or Acorn users, Z-80s if they had a Sinclair and 6809s if they had a Dragon or Tandy.

The supposed benefits of compatibility with the IBM PC drove some to adopt 8085s and 8086s and there was a sprinkling of Z-8000s and an 80186s.

Top, everything you wanted on a micro except a spacebar. TV, phone, video recorder and computer in one portable unit. Aphrodite, above, and Da Vinci, right use more conventional technology.

Built-in light pens and joysticks seem popular although most designs included a provision for the joystick to be detached from the keyboard when necessary. Alexander Martin, whose sketch carried the doleful note "Product design gradute — job needed" included a detachable trackball in his plan.

While most of the light pens where intended for drawing on screen or selecting from a menu Matthew May's consisted of a light bulb on the end of a wire "for programming in the dark". Richard Heimans gave the credit to his mum for suggesting a remote control joystick and several designs used infra red or ultrasonic beams to communicate between peripherals.

Most of the battery-powered micros suggested included some sort of flat screen display on the keyboard even if it was only a single-line liquid crystal display. One cheap and easily practicable idea which occurred to both John Niven and Patrick Lawton was a little watch-style LCD showing how much free memory is left in the computer at any time.

By incorporating a battery — as Andrew



Peter Au-Yeung's 8,000 word submission, below, soon became know as "The Book".

Rice suggested you could make it a real time clock too. This could be used to datestamp files as you created them. A warning panel flashing up messages such as OH — overheating — was yet another proposed use for an LCD.

Most of the competitors wanted between 16 and 128K of RAM in their micros with easy interfacing to floppy or even hard disc units for extra storage. Silicon discs were one of the more original ideas for additional storage. These would look just like games cartridges but would contain a small battery and up to 256K of RAM on CMos chips which need little powers to keep the memory refreshed.

When you plug one of these into your micro it will behave like a disc drive except with instant access. You can unplug it safely without losing the information on it.

The competition was split into three categories and although there was an overwhelming response in the Junior and Open sections we had relatively few group entries. Many of the group entries were meant to be IBM compatible.

The best of these were the Phoenix — a £230 128K micro designed by Hove Park School Computer Club and the Adept 42 BC, sent in by David Moore from Dorset, which has a built-in disc drive. The 42 BC has a number cruncher unit in addition to the 8088 to speed up calculations — this is a primitive form of multi-tasking — leave out the word primitive as David Moore suggests and you have "an ideal selling point to the gullible".

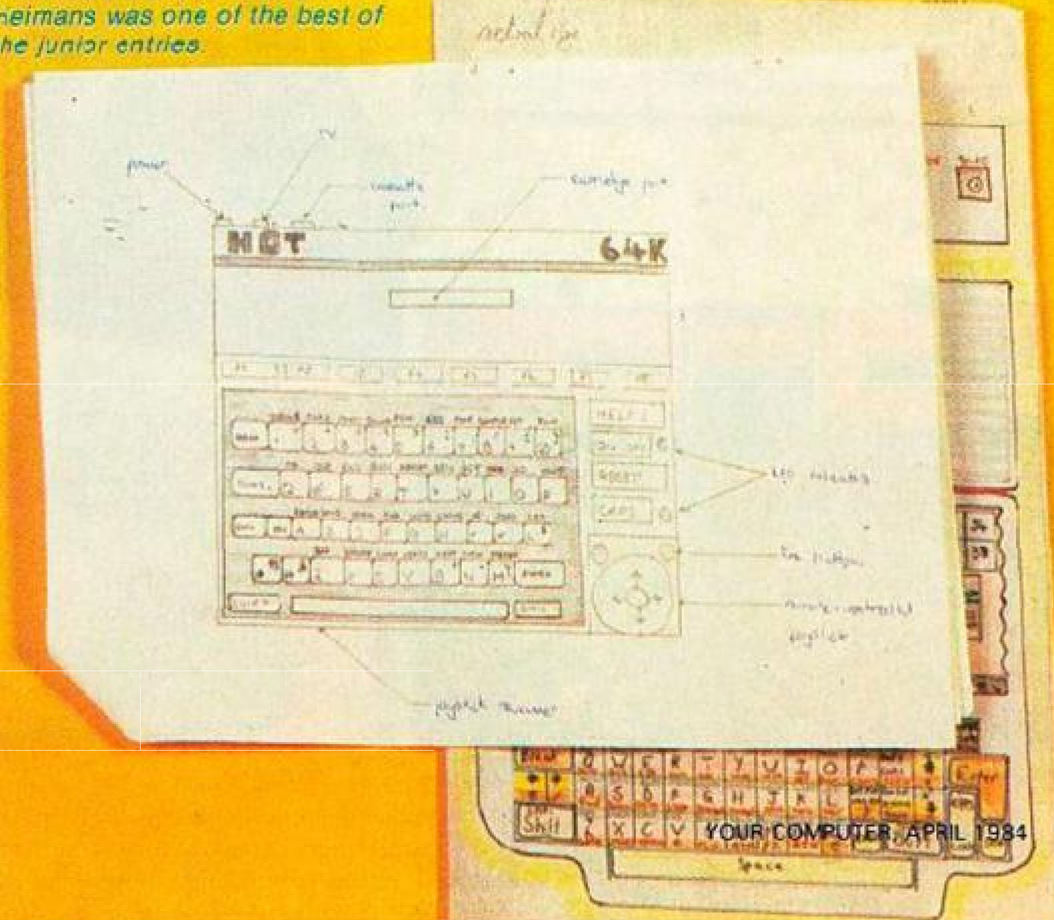
In top mode the 42 has 924×240 resolution taking up a massive 57K of screen memory. The £450 price tag suggested for the Adept sounds a little optimistic for a 128K machine with a built-in 5.25in. disc drive.

The Phoenix attempts to squeeze extended Microsoft Basic, Logo and an operating system into 16K of ROM. It also has a sound range of 12 octaves — well beyond what humans can hear — presumably in case there are any dogs or mating prawns in the audience. Automatic Load and Save buttons make the Phoenix user's life easier.

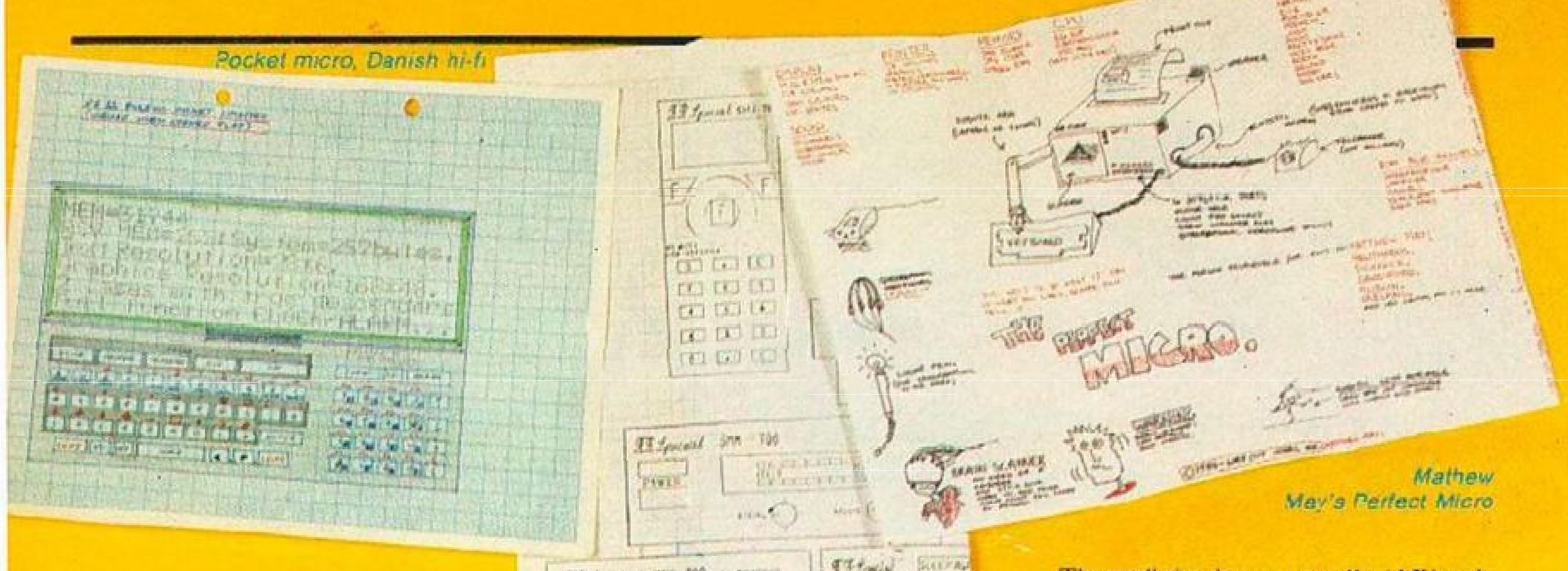
6502s were also popular with the group entries. Silicon City Micro was a £150 Commodore 64 look-a-like with a built in detachable joystick. The cheaper 16K Prism concentrated on making interfacing easy with a MIA chip — miniature interface adaptor.

At Junior level the under 14s were not afraid to send in circuit diagrams. Barry Adams did with his anonymous 64K Z-80 micro. For £170 it looked good value and well thought out but 28 graphics modes would frighten all but the most daring new users. 10 year old Michael Davis's Zodiac, on the other hand was a simple but effective idea for a BBC

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Hot 64, below, from Richard Heimans was one of the best of the junior entries.



Pocket micro, Danish hi-fi

Mathew May's Perfect Micro

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compatible 32K computer with a built-in cassette drive. If only Acorn had had a look at Michael's design the Electron might be blessed with cartridge and printer ports, though the flat screen he suggests would have made the Electron even later.

John Niven from Oman, who thought up the LCD RAM counter, proposed a 48K micro with the odd mixture of Z-80 and 6809 processors and BBC-style Basic. Nicholas Speed wanted to supply four language cartridges with his 64K Ideal M84 — Basic, Logo, Pascal and Forth.

Heimans Operational Technology, alias Richard Heimans from Camberley, had a real keyboard, improved sound 64K RAM and 6502 chip four about £120. A built-in compiler was one of Richard's priorities.

In the Open the competition was toughest of all. Peter Au-Yeung's submission — which because of its weight soon became known as "The Book" was very carefully thought out, with a Z-80 and an 8085 but with only 80K RAM and no built-in storage for around £500-£600 it would have a limited market. David Kinrade's pocket micro — half the size of a paper back book — was immediately appealing. When you open it up there is a six-line LCD in the lid. The proposed 6502-compatible CMos CPU is coupled with 64K RAM.

The small size does not stop David Kinrade from building in two joystick ports and facilities for expansion. A little add on unit would make 128K silicon discs for mass storage.

Flemming Pedersen from Denmark went for a modular approach with Modem, printer/plotter and even power unit all designed to stack with hi-fi units including a stereo cassette deck which doubles up as computer storage. His FP Special would be a 64K 68000-based micro with remote control of peripherals and remote joysticks. Maximum resolution would be 640 × 512 and Flemming Pedersen is working on a new language called Plim for his FP Special.

Duncan Kinnaird's Aphrodite concentrated again on peripherals — including a laser disc player and piano keyboard. The most imaginative entry came from TM Colver with his go-anywhere portable micro incorporating a radio telephone, colour TV and video recorder. Two cassette units taking video tape would act as TV or computer storage. Colver's micro would have twin CPUs — Z-80 and 6502 — presumably CMos versions unless you planned to take a yak loaded with car batteries on your travels. The radio telephone might have to wait for cellular radio before you could make the most of it and it might take a couple of years before flat screen colour TVs become cheap and reliable.

So much for *Your Computer's* view of your entries. Now we are taking the leading designs in each category to the computer companies for their opinions. Watch this space. ■

GAMES WRITING PACKS

Producing fast-action games without the need to learn machine-code programming — Simon Beesley reviews a crop of games designers including the newly-released Hurg.

THERE ARE FEW more dismal experiences than playing a version of Space Invaders written in Basic. The invading aliens dawdle across the screen while your missiles take an age to reach them. The fact is that Basic is usually too slow for writing adequate arcade games. For best effects you need the speed and flexibility of machine code. But for most of us learning machine code is a daunting task.

As an alternative there are now a number of programs which offer a more painless way of writing arcade quality games. These are either extensions to Basic or full-blown games designers.

Melbourne Houses's Hurg is such a program. Hurg, incidentally, stands for High-Level, User-Friendly, Real Time, Games Designer. The terms High-Level and User-Friendly refer to the fact that by using Hurg you can design a game without writing a line of code — the entire system is menu driven. It offers, in fact, an extensive hierarchy of menus and sub-menus which between them cater for almost every aspect of designing a game.

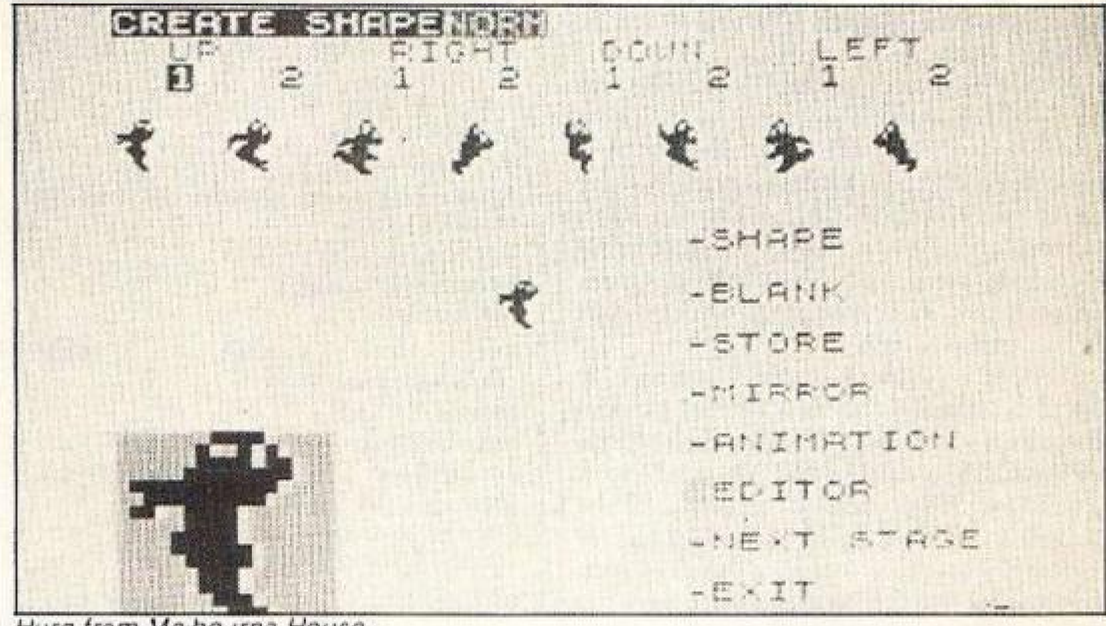
Define eight objects

Not only, for example, can you define up to eight different objects but you can also animate each in a different way and determine how it is to move. Movement can be described in considerable detail. You could instruct an object to mimic the movement of another object or give a weighting to movement in certain directions. Alternatively you could define eight paths and link four of them together.

The animation facility is extremely impressive. Each object can be given up to eight animation sequences. It can either be allotted two different shapes for each direction or be made to pass through an entire eight shape cycle in every direction. Once you have defined its shapes you can set the speed at which animation occurs as well as the speed with which the object moves across the screen. The Shape Generator is one of the most enjoyable features of Hurg. In effect it lets you construct the frames for a cartoon. As soon as you have defined at least two different shapes you can see your cartoon character in motion.

There are a host of other options such as a regeneration menu, a collision table, and a games variation menu. To take just one of these, the games variation menu allows you to alter the pattern of a game after a specified event. Thus you could instruct the ghosts in a Pacman-type game to move away from the player when a power pill has been eaten.

Although there is no facility for designing a background you can load in a predefined screen. This means that an assortment of different games can be designed. Two of the demonstration games included with Hurg show its range. Manic Koala is a creditable Manic Miner type game — with only one screen — while Ms Hortense is a Pac-Man variation.



Hurg from Melbourne House.

Designing a complete game with Hurg is quite a complicated business. The program's facilities are so extensive that they need much fuller explanations than are given in the manual. More examples are needed. The manual gives an example of how to write a simple game but this is rather sketchy. When I came to design an Invaders type game I was unable to make my missile leave its silo. Doubtless I had made an elementary mistake but detailed step by step instructions would have been handy.

Quicksilva's Games Designer is easier to use but more limited in its scope. Essentially it is an instant shoot em up kit. Seven game formats are open to you — Invaders, Asteroids, Scramble and so on — but these are really a matter of fixing the directions the aliens come from and how your character moves. The program does not allow you to design a game at the same level of detail as Hurg. So you are confined to producing variations on the same shoot-em-up theme: aliens approach and you blast them out of the skies.

Again, it is menu driven. There are eight options on the main menu: Play Game, Select New Game, Alter Sprites, Configuration, Movement, Attack Waves, Load from Tape, and Save to Tape. Selecting any one takes you to another section. The sprite option, for example, takes you to a character definer where you can define either your own player and missiles or the enemy characters and their missiles.

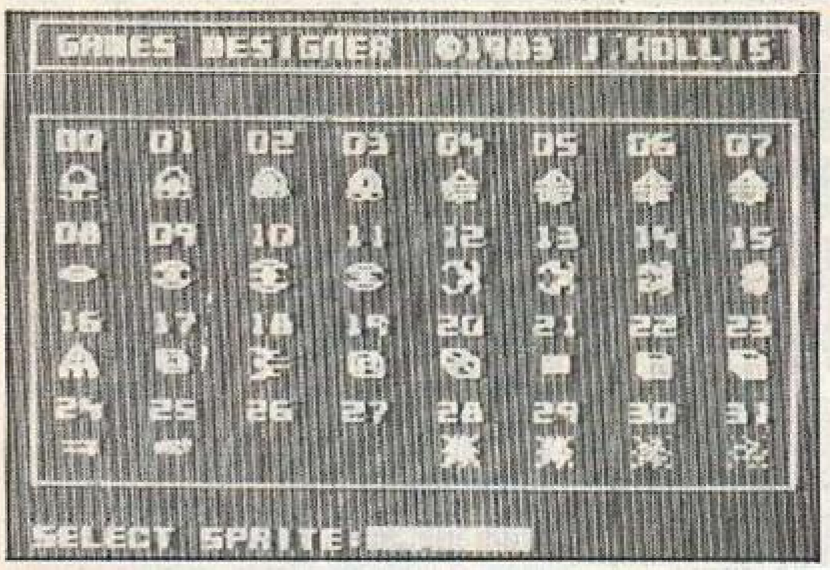
Included in the configuration sub-menu is quite a sophisticated sound editor — a feature lacking in Hurg. By moving a slide up and down on five scales you can create the sound of your choice for explosions or missiles. Given the range of different sounds that can be produced this is particularly simple to use as well as being fun to play with.

Although you can give the aliens a limited degree of animation and set their flight path you cannot animate your own character. This feature does not begin to compare with Hurg's extensive facilities for defining animation and movement. Only one set of aliens can appear on the screen at any one time and all move in the same way.

Nor is it possible to define the background. The background option reduces to a choice of colours and the decision to include stars or not.

But for all its limitations Games Designer is

(continued on next page)



Above and above left: Games Designer from Quicksilva

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a highly effective package. The eight predefined games which are included with it show that you can certainly design games of commerical quality. If shoot-em-ups are your taste then this progam will allow you to indulge yourself to the full.

Games designer programs, however, have their frustrations. They restrict you to a set course menu. With Hurg, for example, it is possible to design a Pac-Man game but you could not instruct the ghosts to move intelligently. As the blurb for Interactive Software's Scope puts it, such programs cannot satisfy those who enjoy 'the challenge of true programming'.

Scope is a computer graphics language. It has 31 command words which are tagged onto Basic Rem statements. They cannot, however, be intermingled with Basic. Once you have written a Scope routine it needs to be compiled into object code in another area of memory. The idea is that once compiled your graphics routine can be called from Basic.

Entire game in Scope

You could also write an entire game in Scope; although with only 31 commands on hand this would be a daunting task. Scope does not allow floating point variables so the sine and cosine functions cannot be used. Nor are there commands for multiplication and division. User-defined characters need to be set up in Basic.

At first glance Scope's syntax seems rather complex. To set up the equivalent of the empty loop

```
FOR A = 0 TO 100 NEXT
```

requires the following commands:

```
10 REM Var,a,0:
20 REM Label;A:
30 REM Incle 1:
40 REM Test;194,a,100,A:
```

But the language's graphic commands like Plot, Draw and Attr are familiar enough; while Fscr is a useful addition which scrolls the screen one pixel in any direction.

By using Scope to build up graphics routines you could undoubtedly speed up your Basic programs considerably. It is also an interesting introduction to lower-level languages — a compromise between Basic and assembly language. As an alternative to Scope one could use a fully fledged Basic compiler or Forth.

Richard Taylor's Fifth is a more accessible aid to writing fast games and, arguably, just as effective. One of *Your Computer's* regular

Company	Game	Price
Melbourne House, 131 Trafalgar Road, London SE10 *48K Spectrum*	Hurg	£14.94
Quicksilva 55 Haviland Road, Ferndown Industrial Estate, Wimborne, Dorset. *48K Spectrum*	Games Designer	£14.94
ISP Marketing Ltd Crown House, 38B High Street, Godalming, Surrey *48K Spectrum*	Scope	£11.95
CRL 140 Whitecapel Road, London E1 1EJ. *48K Spectrum*	Fifth	£9.95
Commodore Business UK Ltd 675 Ajax Avenue, Trading Estate, Slough *Commodore 64*	Simons' Basic	£50

contributors Richard Taylor needs, as they say, no introduction. In an interview he once said that he likes to make machines do things they are not designed to do. Having given the ZX-81 high resolution and speeded up its loading rate, he is now doing amazing things for the Spectrum. Fifth is a 4K extension to Basic which lets you harness effects normally only available through machine code. It supplies 25 new commands and a further 13 functions. To use them you simply enter the commands and their parameters after Rem statements.

The largest group of commands provide the Spectrum with a sprite facility. The beauty of this is that since the sprites are interrupt driven they move independantly of your program. You can specify the direction of one of up to 255 sprites and then set the speed and number of pixels they jump at a time. Once set in motion the sprites carry on moving while the program attends to something else. If a sprite collides with another object or veers off the screen control returns to Basic whereupon you can redirect it.

Along with the sprite facility Fifth offers a number of other new commands. Among them are Sound, a far more powerful instruction than Beep, and Replace which changes colours on screen in a similar way to the BBC's VDU 19 command. With Get and Put you can store away any rectangular section of the screen and then reprint it at a new position.

Put together these facilities make up a highly useful tool for writing quality games without dipping into machine code. The sprites are particularly impressive. As they can be set to move pixel by pixel at a rate of 50 jumps per second they are both fast and smooth.

The Commodore 64 already has sprites but using them in Basic is a slow and tedious business. Almost unchanged since the days of the PET, Commodore's Basic now looks a little long in the tooth. It has no specific commands to handle sprites, high resolution graphics or the 64's sophisticated sound chip. To access these facilities you must instead rummage through the manual in search of the requisite Pokes.

Simons' Basic remedies this state of affairs. It is an extension to Basic which makes good the resident Basic's shortcomings with a further 114 commands.

Number of novelties

With the Simons' Basic cartridge in place Commodore's Basic can hold its own and indeed feel superior to any other version of the language on the market. Before writing it David Simons drew up a shopping list of all the commands and features he would like to see in his ideal Basic. And here they all are: structured programming features such as Repeat Until and local variables; programming aids such Auto, Trace and Renumber; error trapping commands, extra string handling commands, scroll commands for any direction; and, of course, an extensive range of instructions to deal with sound, high-resolution graphics and sprites. There are also a number of novelties like Delay which varies the rate at which a listing is printed, and Disapa which hides a program line as a security aid.

The graphics commands, in particular, do all you could hope for. To mention just a few, Paint fills in an enclosed area, Rec draws a retangle, while Rot will rotate and expand a predefined shape.

In return for 8K of your RAM Simon's Basic gives you a remarkable number of new software features. Some were sorely needed, others can be considered bonus extras. The pity is that Commodore did not think to rewrite its Basic at the outset incorporating some of these features in the ROM. ■

ORIC(16&48K) TANDY COLOUR(16K)
DRAGON 32

SKRAMBLE



Actual picture of screen on
ORIC 48K

Your mission is to penetrate the enemy scramble system and destroy their headquarters. You will start with three of our latest spacefighters equipped with repeating cannon and twin bomb launcher. If you succeed in evading the elaborate ground defences, you will arrive at the Cave where flying becomes more difficult. In the cave are UFOs, after which you must avoid a hall of meteorites. Very few pilots succeed this far, but if you do, then you must enter the Fortress, followed by the Maze. If you manage to destroy Enemy Headquarters, then your reward will be a more difficult mission! One or two player game.
Machine Language, High Speed, Arcade Action. Full colour graphics with sound. Keyboard or Joystick control.

Available on tape for
ORIC £5.50 DRAGON 32 £8
TANDY COLOUR £8
(Tandy colour version only available at Tandy Shops)

Orders by post to
41 Truro Road, St. Austell,
Cornwall PL25 5JE.
Credit Card Hotline 0726 3456



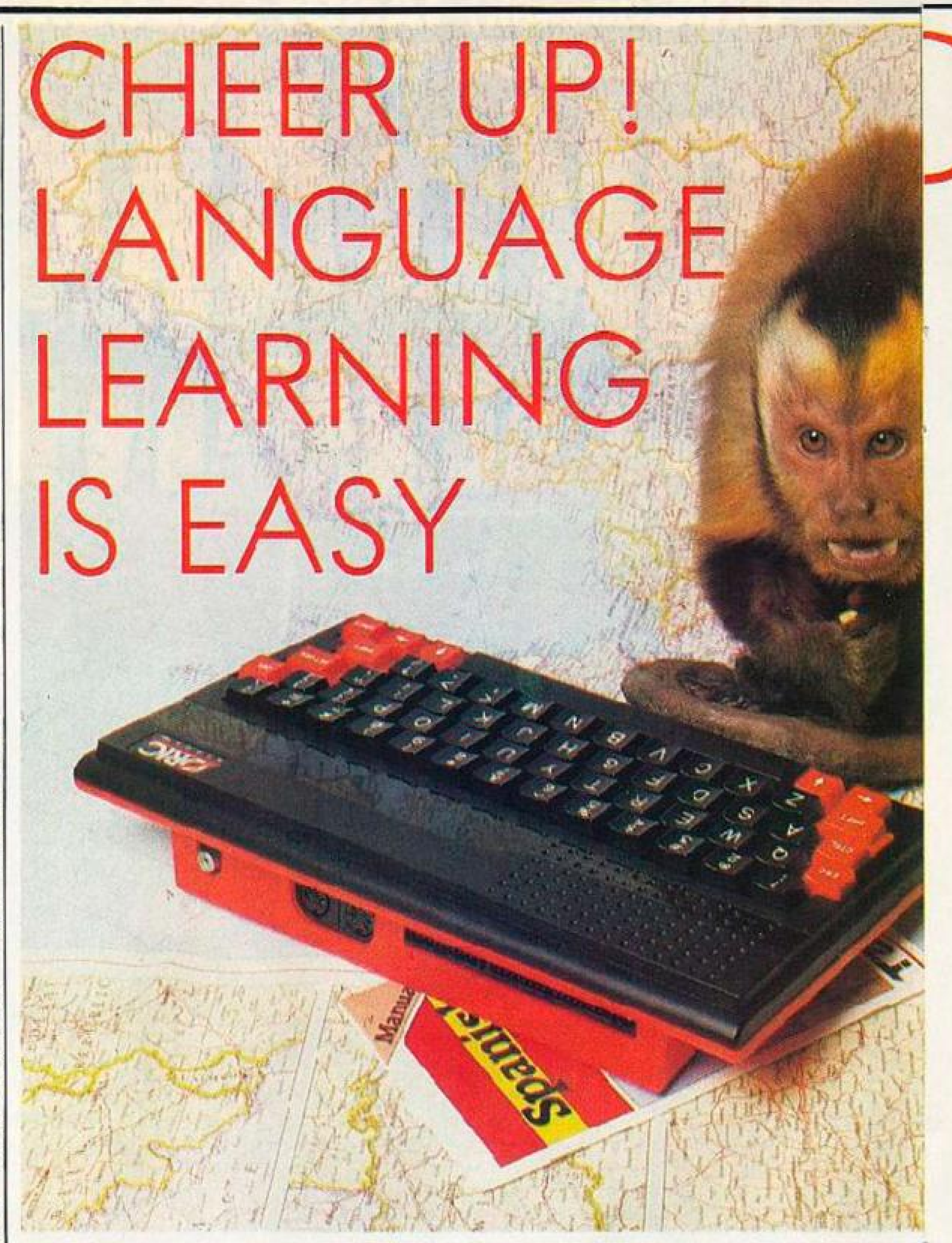
Selected Microdeal titles are available from larger



Stores and Computer Shops Nationwide

MICRODEAL 1984

CHEER UP! LANGUAGE LEARNING IS EASY



As THE SCREEN CLEARS a surreal message flashes up in front of you — "Imagine" it says "the Edinburgh Tattoo being held on your roof". The idea is that you will use Tattoo as a link word to remind you that the Spanish for roof is tetto.

It sounds crazy but it seems to work and now companies like Acornsoft, Tansoft and Silversoft are racing to produce Linkword programs teaching as many languages as possible before the Summer holidays. Tansoft is in the lead at the moment with French, German, Italian and Spanish learning packages already on sale for the Oric 1 and Atmos. Silversoft is releasing Linkword languages on the Spectrum and Acornsoft has already produced BBC versions with the Electron soon to follow.

Over the next few months Dragon Data and Camputers will produce Linkwords on the Dragon and Lynx, English Software on the Atari and Audiogenic is perfecting versions for the Vic-20 and Commodore 64. All this despite the fact that on paper Linkword does not look very impressive. All it claims to do is teach you a 200 word vocabulary and a crude grammar for whichever language you pick.

Beside the seaside

Why then has it received such an unprecedentedly favourable response from the software houses who reject hundreds of programs for every one they publish? Foreign language teaching programs for computers are nothing new. The Atari among others has had one since 1980. But most of these early programs were expensive and over ambitious. The intimidating eight casette Atari package ran to £40. Meanwhile two factors have changed.

First the home computer has become an ordinary household good rather than just an exotic toy — potentially a learning machine in every home. The software houses have realised that the millions of families who now have micros are a ready market for a cheap, fun way of learning the ropes of a foreign language before going away on holiday — so long as the price is right — say £5 to £15.

Secondly authors have produced a crop of lively programs which make no pretence to teach a whole language but aim at quickly and painlessly giving a potential tourist enough to get by on.

The Linkword method is only one of these new ideas. French is Fun and German is Fun by CDS are even more approachable — and make good use of graphics. The CDS tapes which cost £6 each for the 48K Spectrum and will soon be available for the Commodore 64 give you a choice of six scenes — house, countryside, beach café, street and school.

When you select one a simple picture appears on screen and then objects materialise out of thin air with their names in English and the foreign language. The beach scene in German is Fun, for instance opens with just the sand and the sky visible.

The sun appears, with the caption "SUN — DIE SONNE" and gradually the whole seaside scene builds up — with even a bouncing beachball and a radio which blares out "I do like to be beside the seaside." Then it tests you by showing the objects and asking you to type in the German name.

One slight problem is that it will only accept the correct letter each time so you find the answer by trial and error. The program is certainly fun and would quickly interest a young child but at the moment there is no guide to pronunciation.

CDS is working on an audio tape for about £4 to go with the program.

The Kosmos language programs — French Mistress, German Master and Spanish Tutor — are more aimed at the needs of schools but are available on the BBC Electron and Spectrum and cost £10.

You really need a teacher to advise you on pronunciation but at least all the accents are displayed over the right letters, unlike the Linkword program. Once you have grown out of the Level A cassette you can shell out another £10 for the Level B which takes you further.

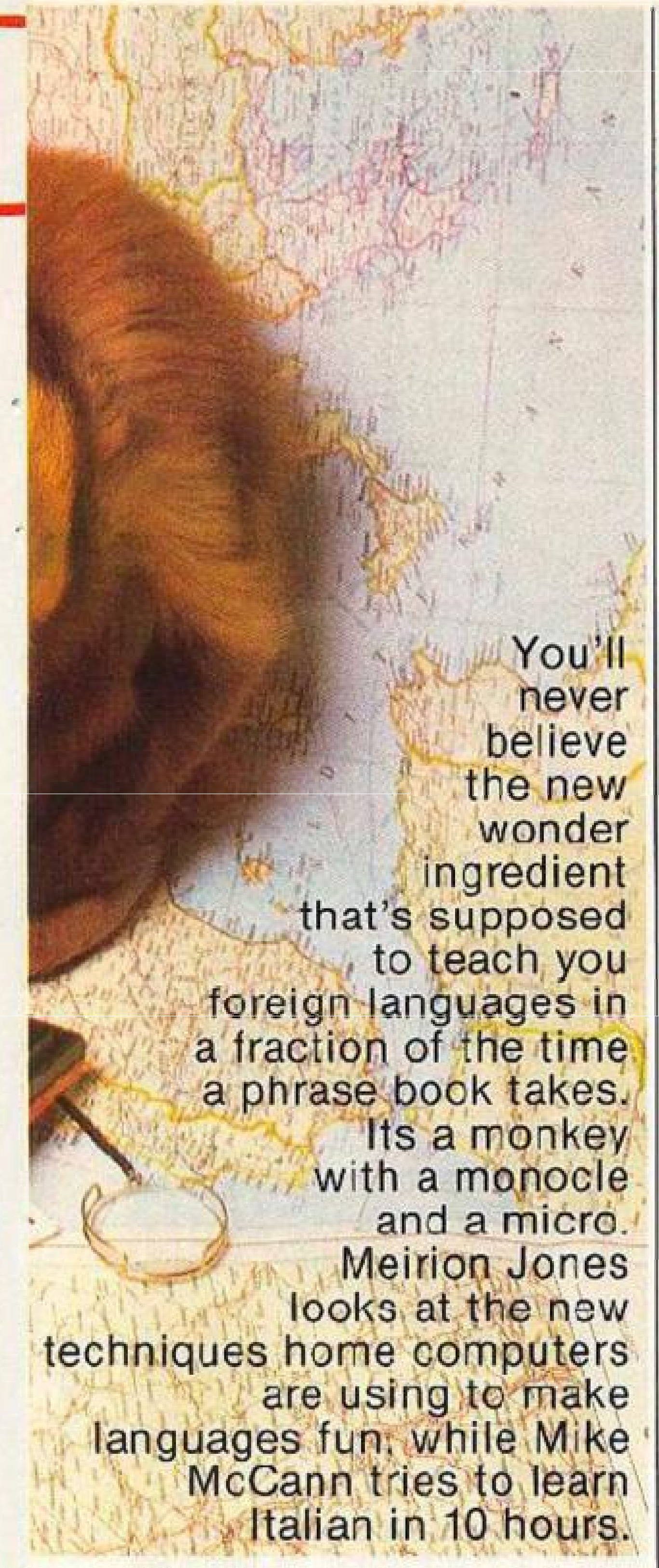
Perhaps because Kosmos aims higher its programs seem less fun and immediately rewarding than the others, but it does give you the capability to create your own lessons and is a massive improvement on learning a language from a book.

The Linkword programs will probably be the lazy tourist's best bet for learning a few words and phrases painlessly. All the versions on the different machines — even the programs for the IBM PC and Junior, Sirius, Apricot, Apple II and Macintosh which ACT is developing are essentialy similar.

Imagine going green

Mike Gruneberg, the University of Wales academic who developed the system, supplied each software house with the volcabulary and link word examples for the four languages developed so far. He is now working on Cantonese, Dutch, Greek, Hebrew, Japanese, Portuguese, Russian and Swedish. You will get very confused if you try learning too many of them.

As it says at one point in Sivlersoft's German Linkword for the 48K Spectrum "Imagine going GREEN after looking at the GRUNEberg Linkword system for too long".



Mike Gruneberg does not claim that Linkword will be right for everybody, "its not the only way" he says "but it is a different way".

His imagination seems to be a strange place infested by salmon leaping over bullfighters, bakers being chased by bees, witty lobsters and of course monkeys, at least to judge by his Linkwords.

The Japanese word for knickers is pronounced "hands upon", or so I am told. I dread to think what Mike Gruneberg will use as a Linkword for that.

There is considerable variation in the prices the companies are charging. For the programs which most of them are supplying with an audio cassette and a leaflet. In each case all the software house had to do was write a relatively simple program for a particualr machine.

Considering they look almost identical on screen it is hard to understand why Acornsoft charges £15 to Electron and BBC owners while Spectrum users need only pay £10 to Silversoft.

NEXT STOP ROME

THIS YEAR five million Britons will leave these shores to experience the delights of another country, another culture and, more often than not, another language. Doubtless they will return with tales of sun, sea, sand, Italian waiters, German beer-festivals, Spanish hotels and French lorry drivers. But the language, what about the language?

We British do not particularly like learning other langauges. We tend to stick to the colonial belief that our mother-tongue should be spoken — or at least understood — by anyone who should have the good fortune to be addressed by the legendary "Englishman abroad". Last century we conquered an Empire to prove the point. Churchill's "History of the English Speaking Peoples" did not help matters, and now the Common Market has only confirmed our linguistic prejudices.

The result is that many of the five million intrepid explorers will have only a few phrases of the language in question, and these will probably have been acquired from an out of date phrase book during the quieter moments of the channel crossing.

But it is possible to learn the bare essentials of a language — 400 useful words and enough grammar to put them into simple sentences — and learn them quickly. That, at least, is the claim made by Tansoft of Cambridge. In fact, Tansoft claims that the computer-based course can teach the basics in ten hours, as opposed to 40 hours using more familiar methods.

For £13 you get two tapes and a small manual-cum-glossary. One tape contains 10 computer programs, each containing one section of the course, while the other is an audio tape to teach you the pronunciation.

An ugly brute

The Gruneberg Linkword Language Course (well, the name makes a welcome change from "Ultima Zone" or "House of Death") was designed by a professional psychologist, Dr. Michael Gruneberg, of University College Swansea, and uses an unusual but effective method to jog the memory and make learning fun. Dr. Gruneberg is in fact something of an authority on memory, having published numerous papers on the subject since 1967. Now he has teamed up with a fellow academic from the relevant language department in Swansea and computerised the lot.

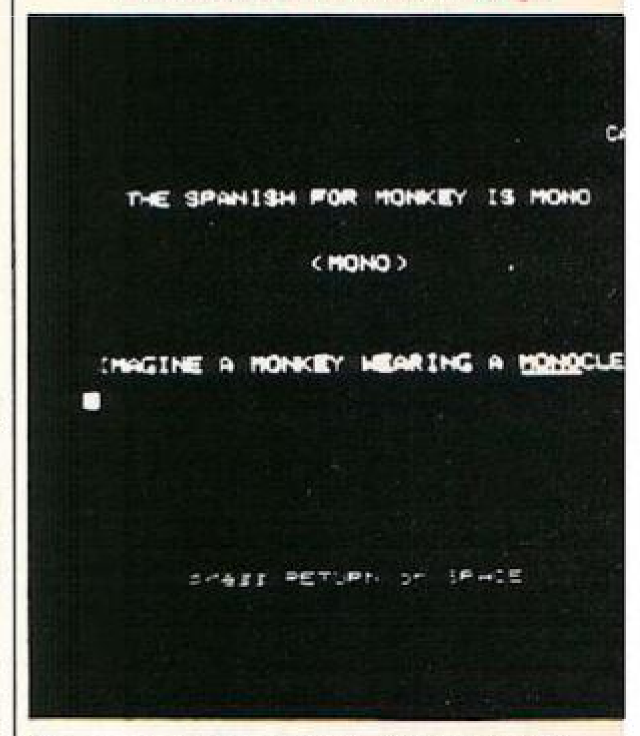
The course works by giving you some strange instructions, such as:

"The Italian for Ugly is Brutto.

Imagine looking at an *ugly brute*"

You then do precisely this for ten seconds and then go on to the next word. After ten words the computer gives you a quick test translate from Italian into English and English into Italian. You then sit back in your chair with pleasure and surprise as you realise that the system does work.

Concentrate on the message below for 10 seconds then turn over the page.



The course is divided into 10 sections, each one teaching you about forty words using this routine, interspersed with some easy-to-pick-up rules of grammar, and before you know it you are constructing your own sentences. Each section takes about an hour to master, including listening to and repeating the pronunciation on the audio tape, hence Tansoft's ten-hour claim. It is advisable, though, not to cram them together — one a day for two weeks is probably what the Doctor had in mind.

The Earth is black

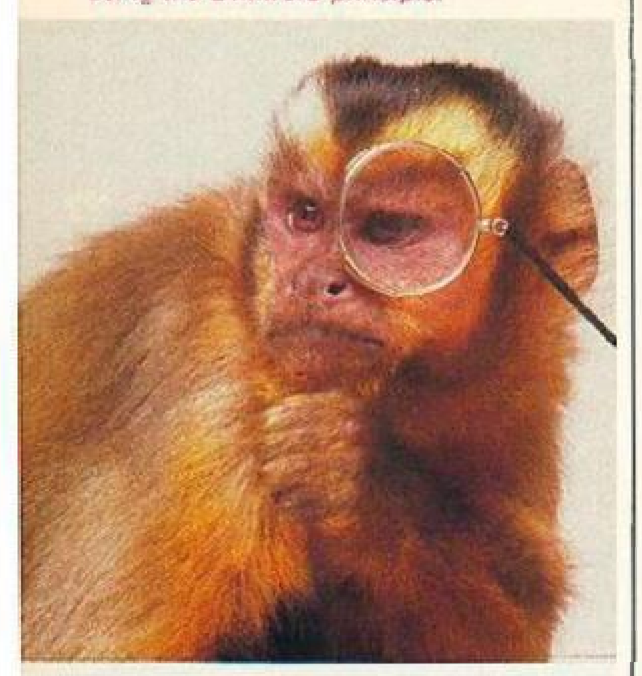
Some of the sentences you are asked to translate are mildly eccentric; "the Earth is always black", for example, while others are worse than the "postillion-struck by lightning" variety. How many times have you had the urge to say "The bonnet and the wheel are very hard, but why is the steering wheel not clean?" There are two reasons for this apparent shortcoming: to illustrate the rules of grammar and to avoid the parrot-fashion recital of stock words and phrases. Some of the more outlandish examples actually seem to stick in the mind because they are so ludicrous. At any rate you quickly progress to such useful bits of information as "In July, August and September the water is very dirty".

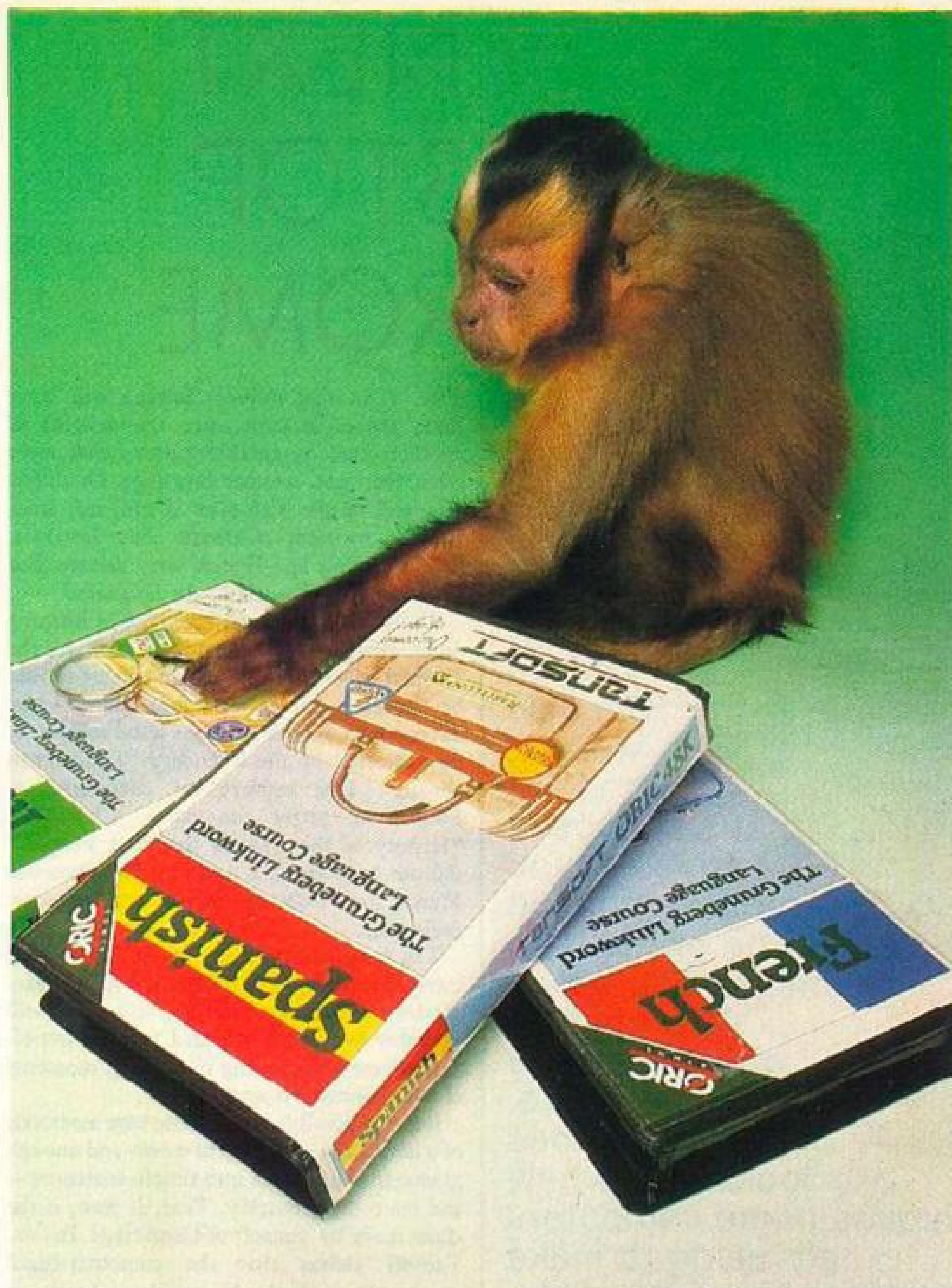
The Gruneberg system uses a neat catch-all visual image for words which sound the same in English as they do in another language. The Italian for piano is "pianoforte", so you are invited to imagine a pianoforte covered in spaghetti. The French equivalent is a piano at the top of the Eiffel Tower (le piano). German and Spanish rely on the National flag — imagine a mouse on the German flag (die maus).

Some of the links do confuse matters, though. It would surely have ben easier to link

(continued on next page)

So now you know the Spanish for monkey using the Linkword principle.





(continued from previous page)

red and white with a well-known Italian drink, rosso and bianco, than to a "bank all painted white". And I remembered good, bad and ugly by thinking of the film rather than the linkword.

One slightly disappointing aspect of Transoft's package is that it hardly uses the computer's graphic or sound capability. A brief flash of the Italian flag at the start of lesson 1 and then back to a simple 2-colour text display. Sound is similarly limited; just a single bleep or musical note as each question is answered. Gruneberg believes that graphics and sound could prove to be a distraction from the learning process, and points to academic research to support him.

Another surprise is that the computer performs each test in exactly the reverse order to the learning order. My immediate reaction was that the programmer was being lazy and didn't want to write a random-order test routine. After a while, however, I found myself remembering a difficult word because it came before or after a more familiar one. And for numbers or days of the week a set order is an obvious advantage. The keep-it-simple philosophy triumphs again.

Operating the program is easy — just a matter of pressing Return when you are ready to go on to the next page or the space bar if you want to have the recommended 10 seconds to concentrate on the suggested image. This makes the courses ideal for those who are not familiar with a keyboard. You can, however, type in your answers if you want to, though the machine will treat these in the same way as before. It does not give you a chance to correct a wrong answer, for example.

The computer takes most of the tedium out of learning a language. In fact, it acts in more or less the same way as a school class mate does — testing and re-testing a list of words you have committed to memory. I wonder if Tansoft is going to incorporate this feature into another program aimed at schoolteachers, which would enable them to write in a list of words — or even chemical formulae — and let the pupils test and assess themselves. I certainly found this package a quick way of learning — quicker than the printed page.

One obvious disadvantage of a computer-based learning system is especially apparent with language. Not many people will take their computers on holiday. Once separated from their Orics, anyone who has used this system has to rely on the glossary in the handbook, which only gives English-to-Italian translation of the 400 word vocabulary. It certainly cannot be used as a tourist phrasebook or dictionary, nor even as a guide to the structure of the course. This seems to be penny-pinching: anyone who uses the system will have to buy a phrasebook if they really want to be self-sufficient abroad, and I would have expected University academics to realise this.

Main use is for tourists

For the most part the courses have been designed to teach you words you will actually need to use abroad, whether you are sunning yourself on the beach, ordering a meal in a restaurant or fuming in a broken-down car. The one exception to this is the section dedicated to the business man. The business vocabularly — words like shop assistant, price, secretary and holidays — is probably more use for small talk and the expense account rather than the boardroom.

The audio tape is probably the most important part of the package. There is a world of difference between the spoken and the written word. The Gruneberg system tells you not to listen to the pronunication until you are satisfied with your grasp of the computer-written word. This strikes me as being unadventurous. Most cassette players have remote control; it would have been a nice idea to use the computer to trigger the audio tape (with the playback socket disconnected, of course), and so learn on a real audio-visual system. A refinement for the future, perhaps.

The Gruneberg Linkword System is surprisingly efficient at cramming in short facts in rapid succession. But it should not be taken too seriously: it is certainly not up to 'O' level standard, though it might conceivably replace the first few chapters of a school textbook. Its main use will be for tourists who want to learn the bare essentials of a language — just enough to get by for a week or two on the Costa del Sol. It's certainly enough to make me want to convert my assets into French Francs and parler with these lorry drivers! ■



IN A TOP SECRET COMPUTER DESIGN LABORATORY NEAR ORLANDO, FLORIDA...
JIM, THIS IS SCOTT ADAMS. THE PROJECT IS READY TO BEGIN! SEND THEM TO ME NOW!
OKAY! WE'LL GET THEM MOVING!
I'D BETTER BRING SOME EXTRA WEBBING! THIS LOOKS LIKE A BIGGY!
HULK ALWAYS WANTED FLORIDA VACATION!
WHERE'S FLORIDA ?!
BEN, GET READY FOR A REAL FIRST. THIS TIME WE'RE GOING ON A COMPUTER ADVENTURE!
BUT STRETCHO... I THOUGHT WE WAS GOING TO FLORIDA!?
BY THE EYE OF VISHANTI, I'VE BEEN MANY PLACES, BUT NOW I SEE THAT SCOTT ADAMS BECKONS AND I MUST GO!
MEANWHILE, BURIED DEEP IN A FLORIDA SWAMP...
LITTLE DO THOSE MARVEL CHARACTERS KNOW WHAT I REALLY HAVE PLANNED FOR THEM!
NEWS FLASH! MARVEL SUPER HEROES ORDERS TO U.K. IN SEARCH OF COMPUTER ADVENTURERS. E.T.A. MAY 1st ADVENTURE INTERNATIONAL

A YEAR IN THE LIFE A SOFTWARE COMPANY

WIDGIT SOFTWARE, one of the first software houses to write for very young children, looks back on its progress in the first year and assesses its future.

From a small start a year ago, WIDGIT Software is now to be found in almost every High Street and has achieved a high reputation for quality and interesting software for children. During the year they have produced seven titles and another four will be ready in the spring. One of Widgit's titles, QUICK THINKING, was chosen by the Mirror Group Newspaper's software company MIRRORSOFT, for its launch in November 1983, and the Commodore 64 version reached number 7 in the Websters charts — an unusual feat for an educational tape.

LEARNING THROUGH PLAY

One of Widgit's main concerns is to write good quality entertaining material which gives good value for money without sacrificing standards. All the programs are essentially games, but each has clear educational aims and a sound basis. The idea is that children learn much better through play. The 'on screen' images and the quality of the graphics must be appealing, full of colour and, where appropriate, animated. High quality use of graphics must be appealing, full of colour and, where appropriate, animated. High quality use of graphics has become a feature of Widgit products and they firmly believe that educational material just the same quality of display as other programs. As far as programming is concerned, Tina says

"We use a mixture of machine code and basic: machine code for the graphics and basic to get a good degree of flexibility. We want to allow for a variety of levels of play and can maintain the interest of a child as his or her skills develop."

HOW IT ALL STARTED

Kate and Simon Detheridge's enthusiasm for computers was the initial driving force behind Widgit Software. At the ages of 2 and 3 they were ready and keen to use computers, but their was no commerical software available. Their parents Mike and Tina had done quite a good deal of programming on business machines, but when the SPECTRUM arrived with its low price and super graphics capabilities, they saw a market potential and immediately set about writing material. With a generation gap growing around computers Mike and Tina were anxious to write material which young children and their parents would use together. They hoped to persuade parents to use computers, and that once they had had 'hands on' experience the computer would take its rightful place as a standard domestic utility item.

Using their experience as teachers, parents and programmers they designed their first set of four tapes for pre-school and infant children. When these were produced in May 1982, Mike and Tina had little idea how the business would develop. They were confident that the market was there and that their programs had the quality to be a commerical success. This confidence was fortunately shared by W.H. Smiths who promptly put Widgit Software on its shelves where it has been selling very successfully every since.



"Simon and Kate testing out some of the programs"

By the middle of August a new tape PATHFINDER was ready for release, and with several ideas in the pipeline, Mike and Tina decided it was time for expansion. Lucas Fowler joined them as a programmer, Vivienne Harling as an educational adviser, and at the same time they were approached by Mirrorsoft. The tape that the team were working on at the time was QUICK THINKING and was published by Mirrorsoft in November.

By christmas the whole Widgit range was available in Boots, and with an export market starting to take off, Widgit was on a firm footing to enter 1984

NOW AND ONWARDS

One of Widgit's best liasons has been with Gordon Askew. Gordon is Head of a primary school in Cheshire and has a great deal of very relevant educational experience. He has made important contributions to Widgit including their most recent release HUMPTY-DUMPTY. Work is now in hand for four more releases, two of which are due for publication very soon. Some programs will be released through MIRRORSOFT and others under the WIDGIT label.

"We enjoy working with Mirrorsoft," says Mike, "apart from the commercial benefit a great deal is gained from the interchange of ideas which we get during the development."

Widgit now feel that they have a broad base of experience and talents to stay in the forefront of educational software

THE PROGRAMS

COUNTING, ADDING & SUBTRACTING and QUICK THINKING are tapes which develop the concept of number from a very early beginning. Care was taken to ensure that the very first program on COUNTING could operate from the very simplest level and the 3 next programs on the tape develop from this. ADDING & SUBTRACTING makes sure the process of counting can effectively lead into simple sums. There are 3 programs on this tape, which with its smooth scrolling and good, clear graphics has been uniformly well recieved by the press and schools.

"Outstanding programs for Infant school:" (Ed. Computing)

"My favourite education tape" (ZX Computing)

QUICK THINKING takes arithmetic a stage farther; it is now necessary to do the sums mentally. The levels are carefully graded from adding single digit numbers to fast time trials which stretch adults! The other program on the tape introduces multiplication tables and number sequencing in a magnificant robot machine.

SHAPE SORTER is a tape to develop visual perception and its simple 2 key operation makes it suitable as a first tape for children from about 2. The first program is simple shape recognition and the second, HOUSES, which can be used as the child gets slightly older is a 'spot the difference' game. On the second level this can be quite hard but there is a lovely reward. The third program is on size sorting.

"they are superb early learning programs" (ED. Computing)

ALPHABET is a program for children as soon as they can learn to recognise letters on the keyboard. Clear, full-screen pictures illustrate each letter and there is an option to relate lower to upper case letters. It is a nice program for aprent and child to start using computers together.

PATHFINDER (for ages 4 to 9) is a series of 4 graded maze games featuring animals. All the mazes are randomly generated and no two are ever the same. They deal with important basic concepts — up, down, left and right, and begin to develop the ability to plan in advance. KANGAROO, the second program leads the player in the direction of simple programming. The graphics are bold and brightly coloured and there is a nice, but not excessive use of sound. Again the reviews of this tape have been very good:

"These games should prove very entertaining to play as well as providing a very real challenge" (Crash Magazine)

"Well done Widgit. A very real application for a home computer, cleverly executed and which does not cost the earth" (Home Computing Weekly)

The HUMPTY-DUMPTY MYSTERY and WHO KILLED COCK ROBIN are two programs on the latest tape from Widgit only recently released, and is suitable from early readers to about 10 year olds. This tape contains 3 programs designed to develop logical thinking and memory. There are 2 games to discover which of the King's 12 men pushed Humpty off the wall, in the first by asking questions and/or guessing and in the second, the player gets a glimpse of the culprit but then has to remember and describe him. Cock Robin asks the daunting question "Can Sparrow's confession be believed?" and through a process of logic and using the clues provided the player must discover WHO killed Cock Robin, WHERE and WHEN. These are very appealing games and are certainly not exhausted after one or two playings. They lead to a lot of discussion when played by a group of children and appeal to quite a wide age range.

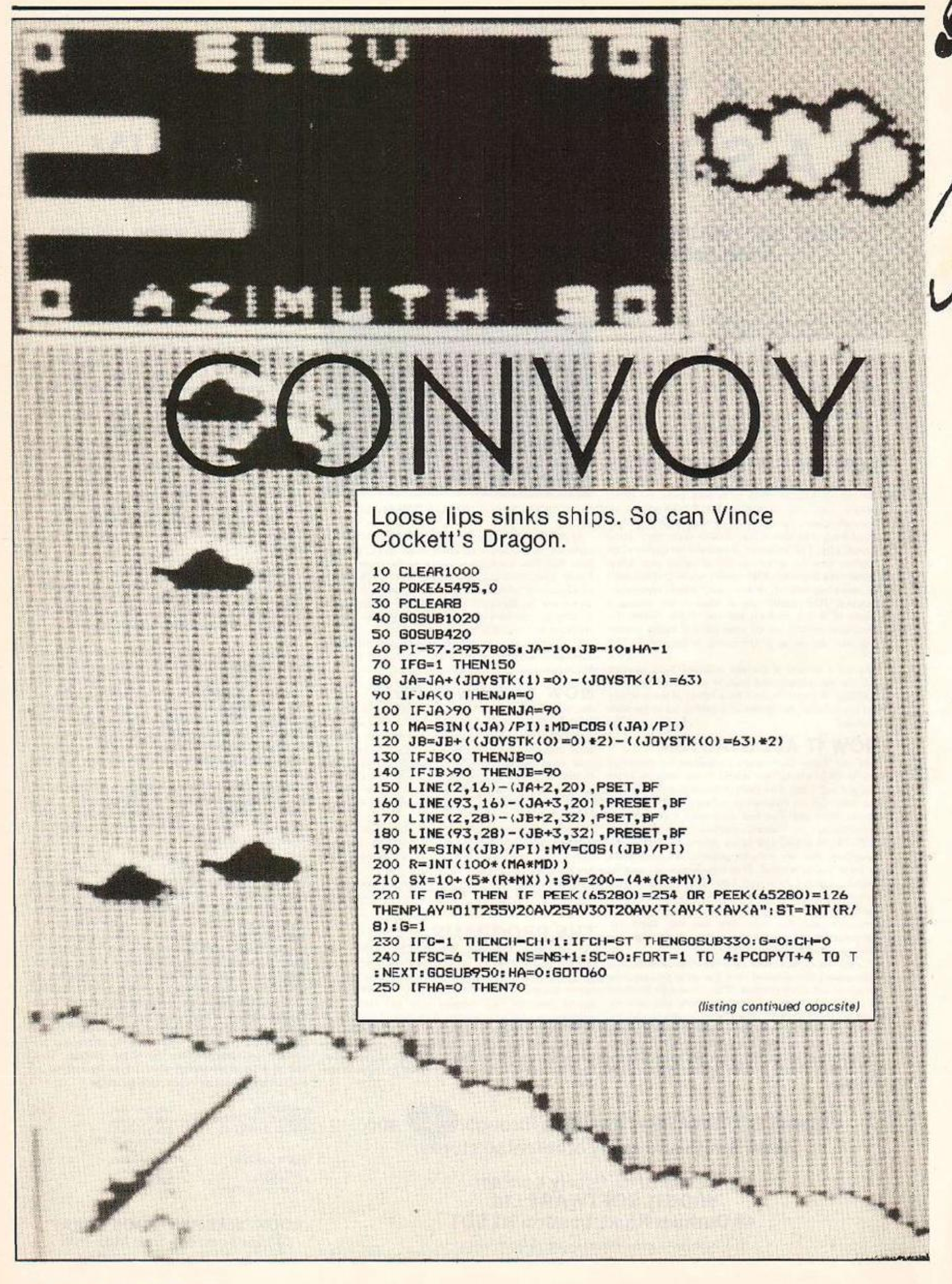
COUNTING	16K Spectrum	5.25
ADDING & SUBTRACTING	16K Spectrum	5.25
QUICK THINKING	48K Spectrum Commodore 64 BBC B and Electron	6.95
SHAPE SORTER	16K Spectrum	5.25
ALPHABET	48K Spectrum	5.25
PATHFINDER	16K Spectrum	5.95
HUMPTY-DUMPTY	48K Spectrum	6.25

WIDGIT SOFTWARE is available through Boots and W.H. Smith and many other retail stores.

In case of difficulty contact
WIDGIT SOFTWARE Ltd.
48 Durham Road, London N2 9DT

Widgit software is a member of the Guild of Software Houses.

LOOK SHARP for 'LOOK SHARP'
Widgit's next title from Mirrorsoft

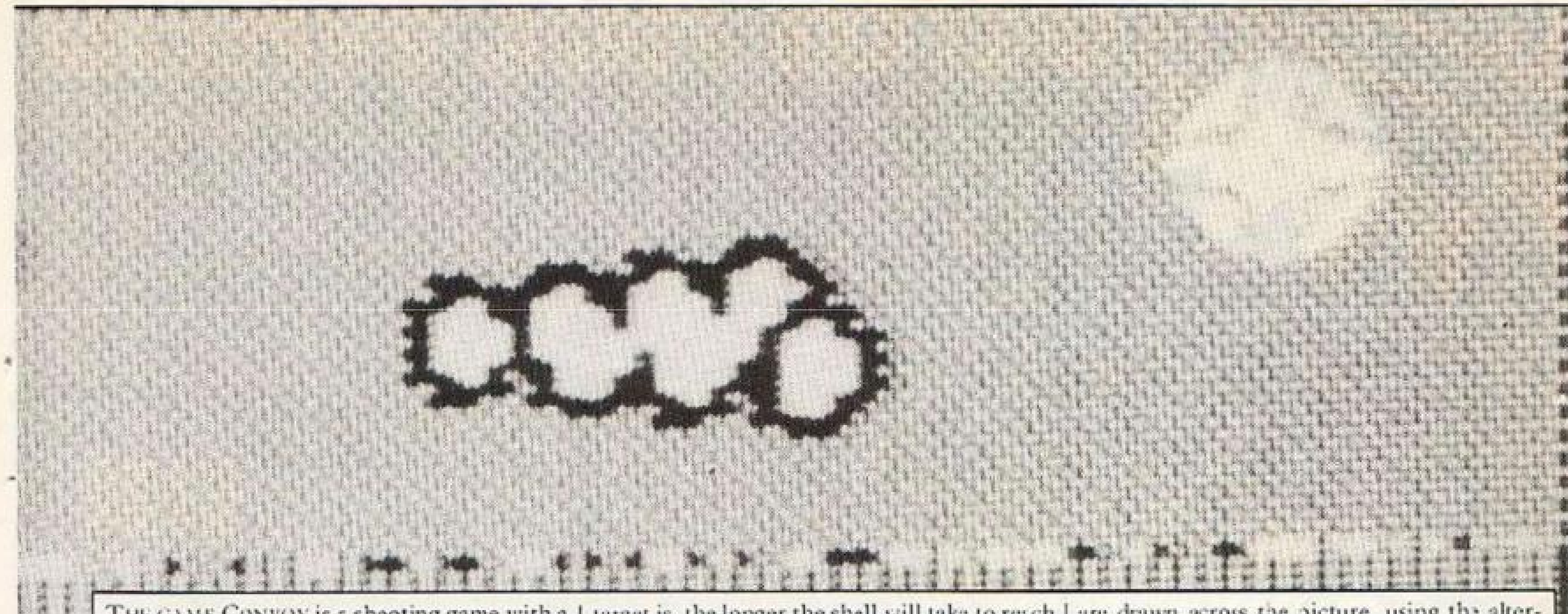


CONVOY

Loose lips sinks ships. So can Vince Cockett's Dragon.

```
10 CLEAR1000
20 POKE65495,0
30 PCLEAR8
40 GOSUB1020
50 GOSUB420
60 PI-57.2957805:JA-10:JB-10:HA-1
70 IFG=1 THEN150
80 JA=JA+(JOYSTK(1)=0)-(JOYSTK(1)=63)
90 IFJA<0 THENJA=0
100 IFJA>90 THENJA=90
110 MA=SIN((JA)/PI):MD=COS((JA)/PI)
120 JB=JB+((JOYSTK(0)=0)*2)-((JOYSTK(0)=63)*2)
130 IFJB<0 THENJB=0
140 IFJB>90 THENJB=90
150 LINE(2,16)-(JA+2,20),PSET,BF
160 LINE(93,16)-(JA+3,20),PRESET,BF
170 LINE(2,28)-(JB+2,32),PSET,BF
180 LINE(93,28)-(JB+3,32),PRESET,BF
190 MX=SIN((JB)/PI):MY=COS((JB)/PI)
200 R=INT(100*(MA*MD))
210 SX=10+(5*(R*MX)):SY=200-(4*(R*MY))
220 IF G=0 THEN IF PEEK(65280)=254 OR PEEK(65280)=126
THENPLAY"O1T255V20AV25AV30T20AV<T<AV<T<AV<A":ST=INT(R/
8):G=1
230 IFG-1 THENCH-CH+1:IFCH-ST THENGOSUB330:G-0:CH-0
240 IFSC=6 THEN NS=NS+1:SC=0:FORT=1 TO 4:PCOPYT+4 TO T
:NEXT:GOSUB950:HA=0:GOTO60
250 IFHA=0 THEN70
```

(listing continued oopcsite)



THE GAME CONVOY is a shooting game with a slight difference. Positioned at the lower left corner of the screen is an artillery gun overlooking the sea. Sailing close in shore is a convoy of enemy ships. By aiming the gun, using the joystick, the convoy has to be knocked out.

However, the range of the shell can be varied, as in a real gun, by varying the elevation. Also the further away from the gun the target is, the longer the shell will take to reach it thereby allowing the ship to sail away from the original target area.

The game is in Mode 4 Black and White. However, by working the first part of the picture drawing routine in Mode 3 and clearing the screen to either colour 6 or 7 and then switching into Mode 4, a blue background can be achieved.

Furthermore if, while still in Mode 3, lines are drawn across the picture, using the alternate colour to the one already chosen to clear the screen, every second line position down the screen an extra pale blue/grey background can be provided.

Note also that because two modes have been used to build the picture, two different resolutions of drawing can be achieved. This has been used to create the textured clouds in the game.

(listing continued from opposite page)

```
260 FORT=1 TO 6:TA(T,1)=TA(T,1)+2:TA(T,2)=TA(T,2)+RND(
3)-2
270 IFTA(T,1)>235 ANDTA(T,3)=0THEN1260
280 IFTA(T,2)<48 THENTA(T,2)=48
290 IFTA(T,2)>150 THENTA(T,2)=150
300 GOSUB1000
310 NEXTT
320 RNT070
330 IFSY<48 THEN400 ELSEPLAY"T20V30O4V30CV20CV10CV5C":
 FORJ=1 TO 4:GET(SX,SY)-(SX+7,SY+7),BL,G:PUT(SX,SY)-(S
X+7,SY+7),SP,PSET:FORDE=1 TO 50:NEXTDE:PUT(SX,SY)-(SX+
7,SY+7),BL,PSET:NEXTJ
340 FORT=1 TO 6
350 IFTA(T,3)=1 THEN370
360 Q=SX-TA(T,1)+4:IFQ<16 ANDQ=>0 THEN380
370 NEXTT:RETURN
380 Q=SY-TA(T,2):IFQ<4 ANDQ=>0 THEN390 ELSE370
370 IFT=7 THENRETURN ELSE TA(T,3)=1:SC=SC+1:PUT(SX,SY)
-(SX+7,SY+7),BL,PSET:PUT(TA(T,1),TA(T,2))-(TA(T,1)+17,
TA(T,2)+11),SL,PSET:RETURN
400 FORT=1 TO 4:DRAW"BM110,44C1NR4U4R4D4BR4NU4R4NU4BR6
U4L2R4BD4BR8;NR4U4R4D4BR4U4NR4D2NR4D2BR12;R4L2L4U2R4BD
4BR4NU4BR4U4NR4D4R4U2NL2D2BR4U4D2R4U2D4BR6U4L2R4":PLAY
"T255O4ABCDEFGO5ABCDEFG":PUT(110,38)-(210,44),A,PSET:N
EXT:RETURN
410 RETURN
420 PMODE3:PCLS7
430 DATA129,131,135,138,131,130,143,132,143,133,133,14
3,138,143,129,131,133,138,143,138
440 DATA133,143,143,138,143,138,143,129,141,133,139,14
3,138,143,133,143,133,139,141,137
450 DATA133,143,143,138,143,138,143,133,134,133,133,14
3,138,143,133,143,133,143,138,143
460 DATA132,140,143,130,140,136,143,133,143,133,143,13
4,135,143,132,140,133,143,138,143
470 DATA174,170,174,234,184,126,176,59,224,7,0,0,128,3
,192,6
480 DATA36,36,36,36,60,153,129,231
490 DATA63,255,252,63,251,248,63,249,241,63,250,227,63
,253,69,63,253,142,63,254,29,63,230,43
500 DATA63,226,55,63,192,115,63,208,235,63,129,221,63,
131,173,63,135,70,63,174,146,63,221,56
510 DATA63,187,121,63,119,57,63,239,51,62,223,47,61,19
1,135,59,127,207,29,255,255
520 FORT=2 TO 9:READA,B:POKE1537+(T*32),A:POKE1538+(T*
32),B:NEXT
530 DIMBO(20),SL(20),BL(2),TA(6,3),A(36),SP(2)
540 GET(4,0)-(21,11),BO,G
550 GET(4,20)-(21,31),SL,G
560 FORT=0 TO 7:READA:POKE1536+(T*32),A:NEXT
570 GET(0,0)-(7,7),SP,G
580 PCLS6
590 COLOR7
600 FORT=0 TO 48 STEP2
610 LINE(0,T)-(255,T),PSET
620 NEXT
630 FORT=0 TO 31:POKE1536+(48*32)+T,RND(128)+127:NEXT
640 A$="U2RU2RURUR2DR2D2RD2
650 B$="D2RD2RDRDR2UR2U2R2U2
660 DRAW"BM90,20;C5":GOSUB680
670 DRAW"BM160,30;":GOSUB680:GOTO690
680 DRAWA$+A$+A$+A$+"BM-4,+6;"+A$+"BM-36,-3;"+B$+B$+B$
+B$:RETURN
690 PAINT(96,20),8,5:PAINT(102,20),8,5:PAINT(124,20),8
,5
700 PAINT(166,30),8,5:PAINT(172,30),8,5:PAINT(194,30),
8,5
710 Y=150
720 DRAW"BM0,150;C5"
730 LINE-(X,Y),PSET
740 X=X+2:Y=Y-RND(6)+4
750 IFY<194 THEN730
760 PAINT(5,190),8,5
770 PMODE4
780 FORT=2 TO 8 STEP2
790 CIRCLE(230,15),T
800 NEXTT
810 GU=1536+(168*32)
820 FORT=0 TO (22*32) STEP32:READA,B,C:POKEGU+T,A:POKE
GU+T+1,B:POKEGU+T+2,C:NEXT
830 LINE(0,0)-(96,48),PRESET,BF
840 LINE(0,0)-(96,48),PSET,B
850 LINE(2,2)-(94,46),PSET,B
860 LINE(0,0)-(255,192),PRESET,B
870 DRAW"BM4,8;NR4U4R4D4BR21;U4NR4D2NR4D2R4BR4NU4R4BR4
U4NR4D2NR4D2R4BR6H2U2BR4D2G2BR23;R4U4L4D2R4D2BR4NR4U4R
4D4
880 DRAW"BM4,44;NR4U4R4D4BR11;U2NR4E2F2D2BR4NR4E4NL4BD
4BR4NU4BR4U4F2NDE2D4BR4NU4R4NU4BR6U4NL2R2BD4BR4U4D2R4U
2D4BR11;R4U4L4D2R4D2BR4NR4U4R4D4
890 GET(110,38)-(210,44),A,G
900 LINE(8,184)-(33,159),PRESET
910 LINE(7,184)-(32,159),PRESET
920 LINE(6,184)-(32,158),PRESET
930 SCREEN1,1
940 FORT=1 TO 4:PCOPYT TO T+4:NEXTT
950 FORT=1 TO 6
960 GOSUB970:NEXT:RETURN
```

(listing continued on page 89)


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(listing continued from page 87)

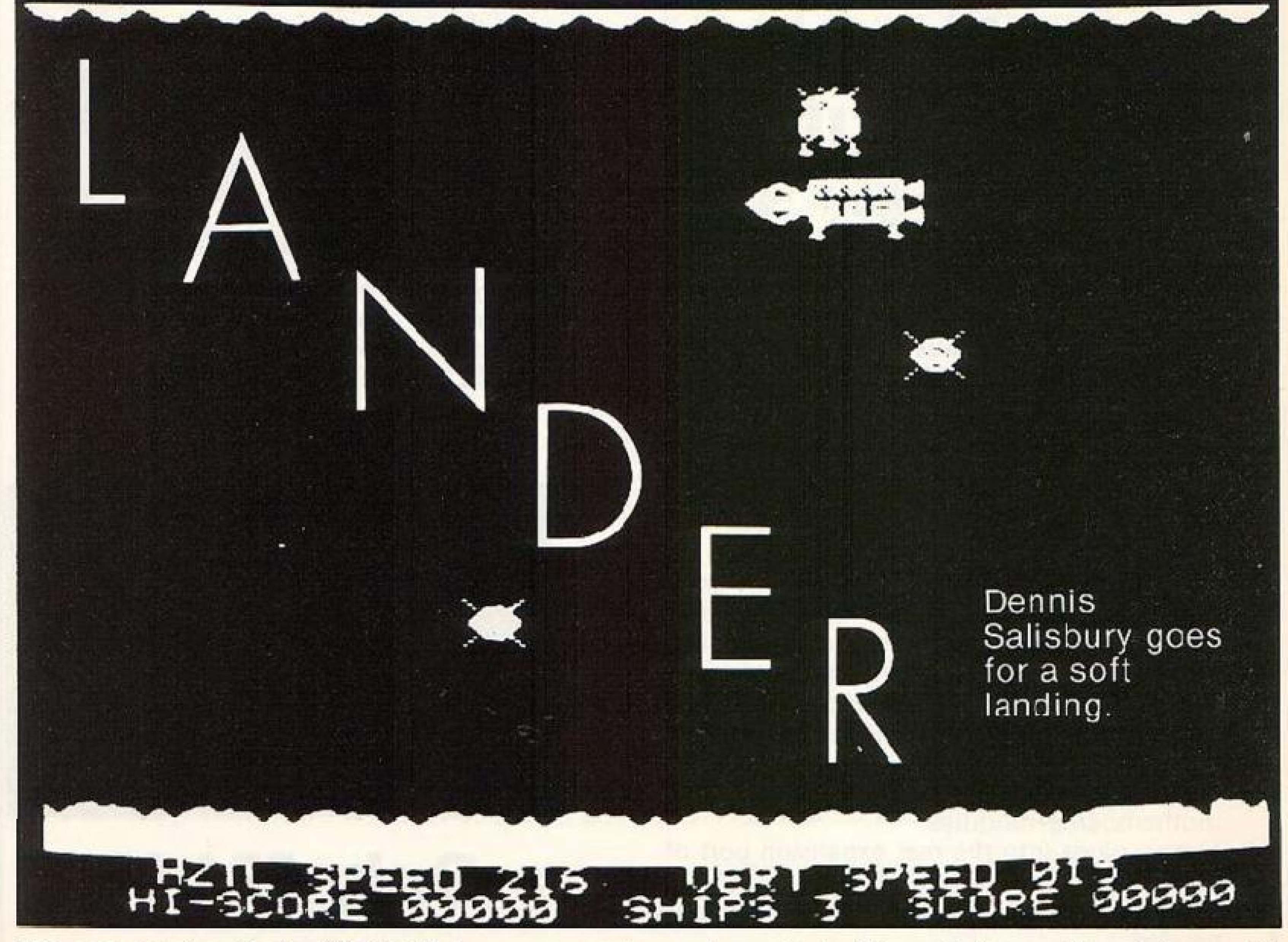
```
970 TA(T,1)=(RND(21)*2)-21
980 TA(T,3)=0
990 TA(T,2)=RND(100)+48:IFTA(T,2)<50 THEN990
1000 IFTA(T,1)>2 ANDTA(T,3)=0 THENPUT(TA(T,1),TA(T,2))
-(TA(T,1)+17,TA(T,2)+11),BO,PSET
1010 RETURN
1020 CLS3:FORT=32 TO 160 STEP32:PRINT@T,STRING$(32,207
);:NEXT
1030 PRINT@480,STRING$(31,233);
1040 PRINT@0,STRING$(32,233);
1050 FORT=32 TO 448 STEP32
1060 PRINT@T,CHR$(233);:PRINT@T+31,CHR$(233);:NEXT
1070 POKE1535,233
1080 P=1159
1090 FORT=0 TO 19:READA:POKEP+T,A+64:NEXT
1100 P=P+32:FORT=0 TO 19:READA:POKEP+T,A+64:NEXT
1110 P=P+32:FORT=0 TO 19:READA:POKEP+T,A+32:NEXT
1120 P=P+32:FORT=0 TO 19:READA:POKEP+T,A+32:NEXT
1130 A$=STRING$(30,42)+"YOUR ORDERS:-ARE TO SINK THE E
NEMY CONVOY SAILING CLOSE TO YOUR SHORES BY USING YOUR
 GUN POSITIONED AT THE BOTTOM LEFT OF THE SCREEN. USE
THE RIGHT JOYSTICK TO CONTROL THE BEARING & AZIMUTH AN
D THE BUTTON TO FIRE"+STRING$(12,175)
1140 PRINT@303,"BY";:PRINT@362,"VINCE  COCKETT";
1150 PRINT@456,"INSTRUCTIONS (Y/N)";
1160 I$=INKEY$:IFI$="" THEN1160
1170 IFI$="N" THEN1240
1180 IFI$<>"Y" THEN1160
1190 FORT=1 TOLEN(A$)
1200 SO=1+(PEEK(1502)AND11)
1210 PLAY"T10;V5;"+STR$(SO)
1220 PRINT@449,MID$(A$,T,30);
1230 NEXT
1240 PRINT@454," PLEASE WAIT A MOMENT ";
1250 RETURN
1260 PRINT@454,STRING$(24,175);
1270 IFSC+(NS*6)>3 THENPRINT@295,"WELL DONE GUNNER****
";:ELSEPRINT@295,"BACK TO THE TRENCHES";
1280 PRINT@359,"YOU SANK "SC+(NS*6)"SHIPS";
1290 FORD=1 TO 1000:NEXTD
1300 PRINT@455,"PRESS SPACE TO PLAY";
1310 IFINKEY$<>" " THEN1310
1320 FORT=1 TO 4:PCOPYT+4 TO T:NEXT
1330 SCREEN1,1
1340 GOSUB950
1350 HA=1:G=0:NS=0:SC=0:GOTO60
```



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Listing 1.

```
2 DOKE#9C,#9A0
5 GOSUB 1000
10 PRINTCHR$(6)
15 CLS:INK 7:PAPER 4:PRINT CHR$(17)
30 PLOT 5,1,10:PLOT 5,2,10
40 PLOT 11,1,"ORIC  LANDER"
50 PLOT 11,2,"ORIC  LANDER"
60 PLOT 11,3,"____________"
70 PLOT 10,5,"By D.Salisbury"
75 PLOT 10,6,"______________"
80 PLOT 3,10,"Controls :-"
90 PLOT 6,12,"Cursor Up    -   Thrust Up"
100 PLOT 6,14,"Cursor Down -   Thrust Right"
110 PLOT 6,16,"Cursor Left -   Thrust Left"
130 PLOT 6,18,"P  -  Pause On"
135 PLOT 6,20,"S  -  Pause Off"
140 PLOT 9,24,"Press any key to start"
150 PLOT 8,24,12
190 GET D$
200 INK0:PAPER7:HIRES
205 INK7:PAPER0:PRINT CHR$(17)
207 CALL#1978
210 CALL#115D
211 POKE#8C,3:POKE#87,0
212 POKE2,2:POKE1,255
213 POKE9,50:POKE4,255
214 POKE11,250:POKE7,250
215 POKE#59,5:POKE#BFD1,53
220 CALL#12D8
230 RESTORE
240 FOR I=0 TO 7
250 READ A
260 NEXT
265 X=0:Y=0
270 FOR I=1 TO 53
280 READ A$
290 CURSET 50+X,70+Y,0
300 CHAR A$,0,1
310 X=X+7
320 IF I=24 THEN X=-20:Y=30
330 NEXT I
335 DATA 0,63,0,0,0,0,0,0
340 DATA 80,82,69,83,83,32,73,32,70,79,82,32,73,78,83,
84,82
350 DATA 85,67,84,73,79,78,83,80,82,69,83.83,32,82,69,
84,85
360 DATA 82,78,32,70,79,82,32,65,78,79,84.72,69,82,32,
71,65,77,69
400 GET A$
410 IF ASC(A$)=73 THEN TEXT:GOTO 15
420 IF ASC(A$)<>13 THEN 400
430 FOR I=0 TO 4
440 POKE#66+I,48
450 POKE#BFDA+I,48
460 NEXT I
470 POKE#80,3
475 CALL#1978
480 CALL#1177
490 GOTO 211
900 END
1000 FOR I=0 TO 7
1010 READ X
1020 POKE 46840+I,X
1030 NEXT I
1050 RETURN
```



LANDER

Dennis Salisbury goes for a soft landing.

THIS GAME IS written for the 48K Oric-1 micro and involves trying to land your spaceship on the surface of a planet where there is only one small area flat enough to land on.

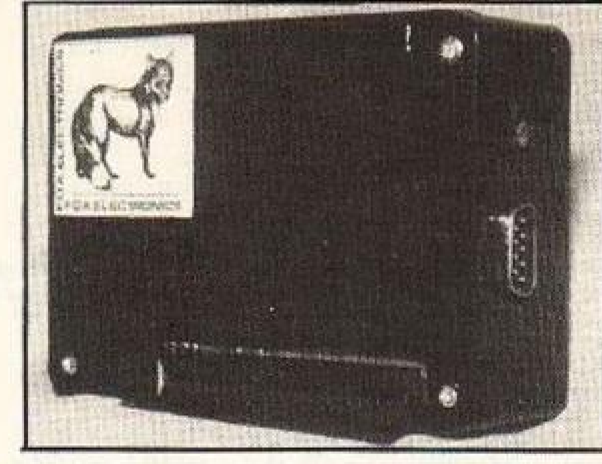
You start off on the back of the mothership from which you must take off without flying into the acid clouds at the top of the screen. Since gravity is continually pulling you towards the planet you will need to use your thrusters to control your descent. Having taken off you must navigate your way past the mothership and avoid the satellites to reach the landing site which may be anywhere on the surface.

Your relative speeds are shown on the horizontal and vertical speed indicators. To land safely your vertical speed must be below about 25 and both feet of your spacecraft must be on the flat area. If you land successfully you will be given a certain number of points depending on how fast you did it, and the next landing will be harder.

You are given five ships to start with and you will lose a ship if you hit the mothership or a satellite, fly into the acid clouds at the top of the screen or land in the wrong place. You

(continued on page 93)

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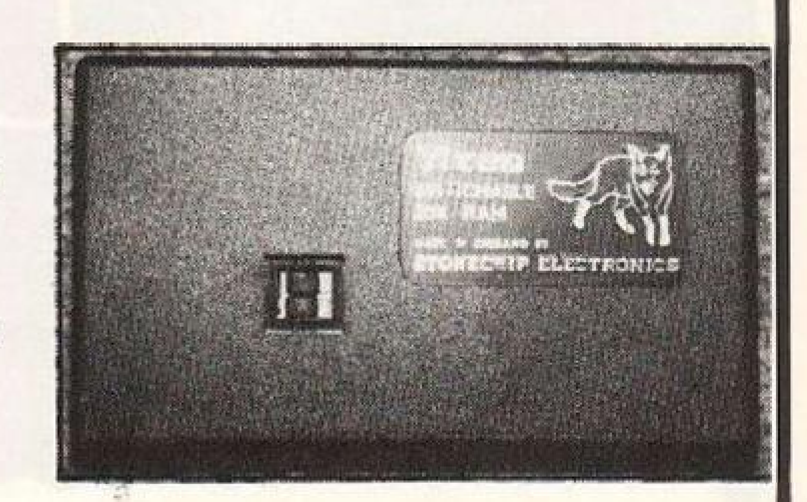
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Listing 2.

```
20 PRINT "INPUT START ADDRESS IN HEX"
30 PRINT "(PRECEDED BY A HASH CHARACTER)"
40 INPUT S
50 PRINT "READ OR WRITE (R/W)"
60 INPUT A$
70 IF A$ = "R" THEN GOTO 135
80 FOR N=S TO #1A00
90 PRINT HEX$(N),
100 INPUT I
110 POKE N,I
120 NEXT
130 STOP
135 PRINT "PRESS ANY KEY"
140 FOR N = S TO #1A00 STEP 10
150 PRINT HEX$(N);" - ";
160 FOR B=0 TO 9
170 PRINT HEX$(PEEK(N+B));" ";
175 X$=KEY$:IF X$ = "" THEN 175
177 X$=""
180 NEXT
190 PRINT
200 NEXT
```

(continued from page 91)

will also lose a ship if your vertical speed is too high when you land or if the mothership reaches the acid clouds before you land.

The controls are: cursor up — thrust up; cursor left — thrust left; cursor down — thrust right; p — pause on; s — pause off.

To enter the program you must first type in the machine code by running the short program in listing 2. Should you wish to save the machine code on tape at any time you should type:

CSAVE "MC", A#1000, E#1A00 [RETURN]

and then type:

CLOAD "MC", A#1000, E#1A00 [RETURN]

when you wish to continue. When you have entered all the machine code type

NEW [RETURN]

and then enter the Basic program in listing 1.

You can run the program

Then type:

DOKE #9C, #1A00 [RETURN]

CSAVE "LANDER", AUTO [RETURN]

You should then be able to run the program. Should you ever need to press the reset button in the middle of a game, type:

POKE #87, 0 [RETURN]

immediately afterwards.

If you wish to make landings easier or harder then type:

POKE #16B8, X [RETURN]

where X is a number from 0 to 255. A value of 255 will make landing almost impossible and 0 will make it very easy.

If you wish to change the number of ships then change line 215 to:

POKE #59, No. of ships : POKE #BFD1, 48 + No. of ships

and type:

POKE #115E, No. of ships

the number of ships must be between 1 and 9.

Machine code dump.

```
#1000 - #40 #48 #5E #40 #61 #7F #7F #61 #73 #7F
#100A - #7F #73 #7F #7F #7F #7F #7F #7F #7F #7F
#1014 - #40 #40 #40 #40 #40 #40 #40 #40 #40 #40
#101E - #40 #40 #40 #40 #40 #40 #40 #40 #40 #40
#1028 - #40 #7F #7F #7F #40 #78 #7F #7F #7F #47
#1032 - #7C #7F #7F #7F #4F #7E #7F #7F #7F #5F
#103C - #61 #62 #62 #61 #7C #4F #74 #6D #7C #6A
#1046 - #6C #40 #7E #5F #57 #7A #7F #7F #57 #7A
#1050 - #7F #7F #6A #55 #64 #49 #73 #53 #42 #50
#105A - #47 #78 #44 #7F #7F #7F #4C #40 #5C #68
#1064 - #6A #6A #70 #41 #7C #77 #5C #73 #5C #47
#106E - #5C #62 #6A #6A #47 #4C #44 #41 #40 #60
#1078 - #7F #5F #40 #7F #5E #7F #7F #7F #44 #63
#1082 - #52 #71 #7F #5F #5C #7F #5E #7F #47 #4C
#108C - #7C #7F #5E #7F #5C #47 #5C #7F #7F #7F
#1096 - #70 #41 #44 #4A #40 #54 #4C #40 #40 #46
#10A0 - #40 #58 #40 #40 #40 #42 #40 #50 #40 #40
#10AA - #40 #47 #40 #78 #40 #40 #40 #40 #40 #40
#10B4 - #40 #40 #40 #40 #40 #40 #40 #40 #10 #7
#10BE - #20 #48 #49 #2D #53 #43 #4F #52 #45 #20
#10C8 - #30 #30 #30 #30 #30 #20 #20 #53 #48 #49
#10D2 - #50 #53 #20 #35 #20 #20 #53 #43 #4F #52
#10DC - #45 #20 #30 #30 #30 #30 #30 #20 #00 #18
#10E6 - #00 #00 #6 #6 #00 #31 #8 #00 #9 #13
#10F0 - #00 #4 #00 #00 #30 #9 #00 #A #10 #00
#10FA - #3A #12 #00 #00 #12 #00 #11 #9 #00 #2
#1104 - #20 #00 #A #26 #00 #32 #11 #00 #4 #C
#110E - #00 #10 #00 #00 #20 #3 #1 #20 #2 #10
#1118 - #34 #8 #38 #7 #1C #E #2E #1D #36 #1B
#1122 - #3C #F #18 #6 #34 #3 #2 #10 #1 #20
#112C - #10 #7 #20 #20 #48 #5A #54 #4C #20 #53
#1136 - #50 #45 #45 #44 #20 #30 #30 #30 #20 #20
#1140 - #20 #56 #45 #52 #54 #20 #53 #50 #45 #45
#114A - #44 #20 #30 #30 #30 #20 #20 #20 #20 #20
#1154 - #7F #7F #3F #7E #4F #7C #43 #70 #FF #A9
#115E - #5 #85 #59 #A9 #30 #A2 #5 #95 #65 #CA
#1168 - #D0 #FB #A2 #00 #BD #BC #10 #90 #B6 #BF
#1172 - #E8 #E0 #28 #D0 #F5 #AD #5 #3 #85 #60
#117C - #A9 #00 #85 #07 #A9 #0 #85 #76 #85 #78
#1186 - #A9 #AC #85 #77 #A9 #B6 #85 #79 #A9 #77
#1190 - #85 #70 #A9 #BE #85 #71 #A5 #70 #85 #72
#119A - #A5 #71 #85 #73 #A2 #00 #A0 #4 #BD #00
#11A4 - #10 #91 #72 #E8 #88 #DC #F7 #A5 #72 #18
#11AE - #A9 #78 #85 #77 #90 #7 #FA #75 #F0 #14
#11B8 - #D0 #E6 #A5 #70 #18 #69 #4 #85 #70 #90
#11C2 - #2 #E6 #71 #A5 #70 #C9 #9F #30 #CB #A5
#11CC - #60 #85 #72 #A9 #BE #85 #73 #A2 #00 #A0
#11D6 - #5 #BD #14 #10 #91 #72 #E8 #88 #D0 #F7
#11E0 - #A5 #72 #18 #69 #28 #85 #72 #90 #2 #E6
#11EA - #73 #E0 #28 #D0 #E6 #A9 #2 #85 #72 #A9
#11F4 - #A4 #85 #73 #A2 #00 #AC #2 #BD #3C #10
#11FE - #91 #72 #E8 #88 #D0 #F7 #A5 #72 #18 #69
#1208 - #28 #85 #72 #90 #2 #E6 #73 #E0 #20 #D0
#1212 - #E6 #A9 #7F #85 #72 #A9 #A6 #85 #73 #A2
#121C - #00 #A0 #6 #BD #5C #10 #91 #72 #E8 #88
#1226 - #D0 #F7 #A5 #72 #18 #69 #28 #85 #72 #90
#1230 - #2 #E6 #73 #E0 #60 #D0 #E6 #A9 #3 #85
#123A - #70 #A9 #A4 #85 #71 #A6 #86 #85 #71 #A9
#1244 - #A6 #85 #75 #A5 #60 #1E #A9 #7A #85 #A3
#124E - #A9 #BE #85 #61 #A9 #0C #85 #7E #A9 #2
#1258 - #85 #2 #85 #5 #A9 #1 #85 #64 #A5 #76
#1262 - #85 #72 #A5 #77 #85 #73 #A5 #78 #85 #79
#126C - #A5 #79 #85 #7B #A2 #0C #A0 #2 #BD #14
#1276 - #11 #18 #69 #40 #91 #72 #91 #7A #E3 #B3
#1280 - #D0 #F2 #A5 #72 #18 #69 #28 #85 #72 #90
#128A - #2 #E6 #73 #A5 #7A #18 #69 #20 #85 #7A
#1294 - #90 #2 #E6 #7B #E0 #18 #D0 #D6 #A9 #00
#129E - #85 #7C #A2 #00 #BD #2C #11 #9D #91 #B7
#12A8 - #E8 #E0 #28 #D0 #F5 #A5 #00 #85 #72 #A9
#12B2 - #A0 #85 #73 #A2 #00 #AC #00 #BD #51 #11
#12BC - #91 #72 #BD #55 #11 #CE #9. #72 #C8 #E0
#12C6 - #20 #D0 #F0 #A8 #72 #1E #6? #20 #05 #72
#12D0 - #E8 #E8 #E0 #8 #D0 #E1 #60 #63 #A5 #00
#12DA - #C5 #1 #D0 #10 #A9 #00 #85 #00 #A5 #2
#12E4 - #C9 #00 #D0 #9 #20 #5C #14 #20 #78 #16
#12EE - #18 #90 #A #C9 #1 #D0 #6 #20 #BE #14
#12F8 - #20 #78 #16 #E6 #00 #A5 #3 #C5 #4 #D0
#1302 - #1D #A9 #00 #85 #3 #A5 #5 #C9 #00 #D0
#130C - #9 #20 #6D #15 #20 #78 #16 #18 #90 #A
#1316 - #C9 #1 #D0 #6 #20 #F #15 #20 #78 #16
#1320 - #E6 #3 #A5 #6 #C5 #7 #D0 #23 #E6 #7C
#132A - #A5 #7E #C5 #E0 #E0 #F #A9 #00 #85 #6
#1334 - #85 #7E #E6 #EA #EA #20 #E2 #17 #20 #1D
#133E - #18 #20 #D9 #15 #A5 #7E #C9 #1 #D0 #3
#1348 - #20 #78 #16 #E6 #6 #A5 #8 #C5 #9 #D0
#1352 - #7 #20 #9F #13 #A5 #0C #85 #8 #C6 #8
#135C - #A5 #7E #C9 #1 #DC #30 #A5 #A #C5 #B
#1366 - #D0 #2A #A9 #00 #85 #A #A5 #5 #C9 #00
#1370 - #D0 #9 #C6 #4 #D0 #2 #E6 #4 #18 #90
#137A - #17 #C9 #1 #D0 #D #C6 #1 #D0 #4 #A9
#1384 - #2 #85 #5 #18 #90 #8 #A9 #00 #85 #5
#138E - #A9 #FF #85 #4 #E6 #A #A5 #59 #C9 #00
#1398 - #F0 #3 #4C #D8 #12 #60 #63 #A5 #7E #C9
#13A2 - #1 #F0 #1 #60 #AD #8 #2 #C9 #9D #30
#13AC - #7 #AD #8 #2 #C9 #B6 #D0 #F9 #AD #8
#13B6 - #2 #C9 #AC #D0 #3C #A2 #E2 #AD #FF #20
#13C0 - #6C #FA #A5 #2 #C5 #00 #D0 #9 #C6 #1
#13CA - #D0 #2 #E6 #1 #4C #5A #14 #C9 #1 #D0
#13D4 - #8 #FA #1 #D0 #4 #A9 #2 #85 #2 #4C
#13DE - #5A #14 #A9 #00 #E5 #2 #A9 #FF #85 #1
#13E8 - #18 #90 #AF #C9 #E4 #30 #30 #A2 #E2 #A0
#13F2 - #FF #20 #6C #FA #A5 #2 #C9 #00 #D0 #2
#13FC - #E6 #1 #D0 #4 #A9 #2 #85 #2 #18 #90
#1406 - #3D #C9 #1 #D0 #7 #C6 #1 #D0 #2 #E6
#1410 - #1 #18 #90 #46 #A5 #1 #85 #2 #A9 #FF
#141A - #85 #1 #18 #90 #3F #C9 #9C #D0 #30 #A2
#1424 - #E2 #A0 #FF #20 #6C #FA #A5 #3 #C9 #C0
#142E - #D0 #8 #E6 #4 #D0 #4 #A9 #2 #85 #5
#1438 - #18 #90 #1F #C9 #1 #D0 #9 #C6 #4 #D0
#1442 - #2 #E6 #4 #18 #90 #12 #A9 #1 #85 #5
#144C - #A9 #FF #85 #4 #18 #90 #7 #A2 #FF #AC
#1456 - #FE #20 #6C #FA #60 #63 #A5 #70 #85 #72
#1460 - #A5 #71 #85 #73 #C9 #10 #85 #65 #A0 #00
#146A - #A2 #3 #B1 #72 #29 #20 #C9 #20 #D0 #17
#1474 - #C6 #72 #A5 #72 #C9 #FF #D0 #2 #C6 #73
#147E - #18 #B1 #72 #69 #1 #91 #72 #E5 #72 #D0
#1488 - #2 #E6 #73 #B1 #72 #A #9 #40 #29 #7F
#1492 - #91 #72 #C8 #DA #C0 #24 #C6 #65 #F0 #6C
#149C - #18 #A5 #72 #69 #28 #85 #72 #90 #2 #E6
#14A6 - #73 #18 #90 #BE #C6 #64 #D0 #E #A9 #6
#14B0 - #85 #61 #C6 #70 #A5 #70 #C9 #FF #D0 #2
#14BA - #C6 #71 #60 #63 #A5 #70 #85 #72 #A5 #71
#14C4 - #85 #73 #A9 #10 #85 #65 #A0 #7 #A2 #4
#14CE - #18 #B1 #72 #4A #90 #8 #C8 #B1 #72 #69
#14D8 - #1F #91 #72 #88 #B1 #72 #4A #9 #40 #29
#14E2 - #DF #91 #72 #88 #CA #D0 #E5 #C6 #65 #F0
#14EC - #E #18 #A5 #72 #69 #28 #85 #72 #90 #2
#14F6 - #E6 #73 #18 #90 #CF #E6 #64 #A5 #64 #C9
#1500 - #7 #D0 #A #A9 #1 #85 #64 #E6 #70 #D0
#150A - #2 #E6 #71 #60 #63 #A5 #70 #85 #72 #A5
#1514 - #71 #85 #73 #A5 #72 #38 #E9 #28 #85 #72
#151E - #B0 #2 #C6 #73 #A2 #10 #A0 #28 #B1 #72
#1528 - #A0 #00 #91 #72 #A0 #29 #B1 #72 #A0 #1
#1532 - #91 #72 #A0 #2A #B1 #72 #A0 #2 #91 #72
#153C - #A5 #72 #18 #69 #28 #85 #72 #90 #2 #E6
#1546 - #73 #CA #D0 #DA #A0 #00 #A9 #40 #91 #72
#1550 - #C8 #91 #72 #C8 #91 #72 #38 #A5 #70 #E9
#155A - #28 #85 #70 #B0 #2 #C6 #71 #A5 #71 #C9
#1564 - #A0 #10 #4 #A9 #00 #85 #5 #60 #63 #A5
#156E - #70 #85 #72 #A5 #71 #85 #73 #E6 #73 #E6
#1578 - #73 #A5 #72 #18 #69 #60 #85 #72 #90 #2
#1582 - #E6 #73 #A2 #11 #A0 #00 #B1 #72 #A0 #28
#158C - #91 #72 #A0 #1 #B1 #72 #A0 #29 #91 #72
#1596 - #A0 #2 #B1 #72 #A0 #2A #91 #72 #38 #A5
#15A0 - #72 #E9 #28 #85 #72 #B0 #2 #C6 #73 #CA
#15AA - #D0 #E4 #18 #A5 #70 #69 #28 #85 #70 #90
#15B4 - #2 #E6 #71 #60 #63 #A5 #74 #85 #72 #A5
#15BE - #75 #85 #73 #C6 #72 #A5 #72 #C9 #FF #D0
#15C8 - #2 #C6 #73 #A2 #10 #A0 #1 #B1 #72 #88
#15D2 - #91 #72 #C8 #C8 #C0 #8 #D0 #F5 #A5 #72
#15DC - #18 #69 #28 #85 #72 #90 #2 #E6 #73 #CA
#15E6 - #D0 #E3 #C6 #74 #A5 #74 #C9 #FF #D0 #2
#15F0 - #C6 #75 #A5 #74 #C9 #A0 #30 #9 #A5 #75
#15FA - #C9 #A0 #D0 #3 #20 #86 #17 #A5 #7E #C9
#1604 - #00 #D0 #3 #20 #0 #16 #60 #63 #A0 #7E
#160E - #C9 #00 #D0 #39 #A5 #70 #85 #72 #A5 #71
#1618 - #85 #73 #C6 #72 #A5 #72 #C9 #FF #D0 #2
#1622 - #C6 #73 #A2 #10 #A0 #1 #B1 #72 #88 #91
#162C - #72 #C8 #C8 #C0 #5 #D0 #F5 #A5 #72 #18
#1636 - #69 #28 #85 #72 #90 #2 #E6 #73 #CA #D0
#1640 - #E3 #C6 #70 #A5 #70 #C9 #FF #D0 #2 #C6
#164A - #71 #A9 #8 #2 #C9 #9C #D0 #C #A9 #1
#1654 - #85 #7E #A9 #C0 #85 #2 #A9 #28 #85 #1
#165E - #A5 #73 #38 #E9 #28 #85 #72 #A5 #71 #85
#1668 - #73 #B0 #2 #C6 #73 #B1 #72 #C9 #40 #F0
#1672 - #3 #20 #B6 #17 #60 #63 #A5 #87 #C9 #1E
#167C - #F0 #3 #C5 #B7 #60 #30 #49 #00 #E5 #1
#1686 - #85 #6D #38 #A9 #00 #E5 #4 #85 #6D #20
#1690 - #F6 #18 #35 #70 #85 #72 #A5 #71 #85 #73
#169A - #E6 #73 #E6 #73 #18 #A5 #72 #69 #58 #85
#16A4 - #72 #90 #2 #E6 #73 #A5 #72 #C5 #60 #D0
#16AE - #64 #A5 #73 #C5 #61 #D0 #5E #A5 #4 #C9
#16B8 - #C6 #0 #7 #20 #C6 #17 #EA #EA #EA #EA
#16C2 - #EA #60 #49 #2 #85 #7E #A5 #7 #38 #E9
#16CC - #32 #85 #7 #B0 #2 #C6 #B0 #A9 #2 #85
#16D6 - #5 #85 #2 #38 #A5 #75 #E9 #A0 #85 #6C
#16E0 - #20 #54 #18 #A9 #FF #38 #E5 #74 #85 #6A
#16EA - #20 #6F #18 #20 #A2 #18 #A2 #FF #A0 #FE
#16F4 - #20 #6C #FA #A9 #5 #85 #72 #A2 #FF #A0
#16FE - #FF #88 #30 #FD #CA #D0 #F8 #C6 #72 #D0
#1708 - #F2 #20 #78 #19 #20 #77 #11 #EA #EA #EA
#1712 - #A0 #40 #1 #B1 #70 #C9 #40 #D0 #4 #20
#171C - #86 #17 #60 #A5 #64 #C9 #1 #30 #C #A0
#1726 - #8 #B1 #73 #C9 #E1 #F0 #4 #20 #B6 #17
#1730 - #60 #A5 #70 #85 #72 #A5 #71 #85 #73 #A5
#173A - #72 #38 #E9 #29 #85 #72 #B0 #2 #C6 #73
#1744 - #A0 #00 #B1 #72 #C9 #40 #D0 #35 #C0 #00
#174E - #4 #D0 #F5 #A2 #11 #A0 #4 #A5 #72 #18
#1758 - #69 #28 #85 #72 #90 #2 #E6 #73 #B1 #72
#1762 - #29 #80 #C9 #80 #D0 #19 #A0 #00 #B1 #72
#176C - #29 #41 #C9 #40 #D0 #F #CA #30 #DE #C8
#1776 - #B1 #72 #C9 #40 #D0 #5 #C0 #1 #D0 #F5
#1780 - #60 #20 #B6 #17 #60 #63 #C6 #70 #A5 #70
#178A - #C9 #FF #D0 #2 #C6 #71 #A2 #29 #A0 #FA
#1794 - #20 #6C #FA #A5 #70 #85 #72 #A5 #71 #85
#179E - #73 #A2 #30 #A0 #3 #B1 #E4 #10 #18 #69
#17A8 - #40 #91 #72 #E0 #88 #D0 #F4 #A5 #72 #18
#17B2 - #69 #28 #85 #72 #90 #2 #E6 #73 #E0 #30
#17BC - #D0 #E3 #A9 #A #E5 #72 #A2 #7F #A0 #FF
#17C6 - #88 #30 #FD #CA #D0 #F8 #C6 #72 #D0 #F2
#17D0 - #C6 #39 #A5 #39 #18 #69 #30 #8D #D1 #BF
#17DA - #20 #78 #19 #20 #77 #11 #60 #63 #A5 #76
#17E4 - #85 #72 #A5 #77 #85 #73 #C6 #72 #A5 #72
#17EE - #C9 #FF #D0 #2 #C6 #73 #A2 #C #A0 #2
#17F8 - #B1 #72 #88 #91 #72 #C8 #C8 #C0 #5 #D0
#1802 - #F5 #A5 #72 #18 #69 #28 #85 #72 #90 #2
#180C - #E6 #73 #CA #D0 #E5 #C6 #76 #A5 #76 #C9
#1816 - #FF #D0 #2 #C6 #77 #60 #63 #A5 #78 #85
#1820 - #72 #A5 #79 #85 #73 #C6 #72 #A5 #72 #C9
#182A - #FF #D0 #2 #C6 #73 #A2 #C #A0 #3 #B1
#1834 - #72 #C8 #91 #72 #88 #88 #C0 #FF #D0 #F5
#183E - #18 #A5 #72 #69 #28 #85 #72 #90 #2 #E6
#1848 - #73 #CA #D0 #E5 #E6 #78 #D0 #2 #E6 #79
#1852 - #60 #63 #A5 #6C #C9 #00 #F0 #13 #A6 #6C
#185C - #E6 #67 #A5 #67 #C9 #3A #D0 #6 #E6 #60
#1866 - #A9 #30 #85 #67 #CA #D0 #EF #60 #63 #A5
#1870 - #6A #C9 #00 #F0 #28 #A6 #6A #E6 #69 #A5
#187A - #69 #C9 #3A #D0 #1E #E6 #66 #A9 #30 #85
#1884 - #69 #A5 #66 #C9 #3A #D0 #12 #E6 #67 #A9
#188E - #30 #85 #66 #A5 #67 #C9 #3A #D0 #6 #A9
#1898 - #30 #85 #67 #E6 #68 #CA #D0 #D7 #60 #63
#18A2 - #A5 #69 #8D #DD #BF #A5 #66 #8D #DC #BF
#18AC - #A5 #67 #8D #DB #BF #A5 #68 #8D #DA #BF
#18B6 - #A9 #30 #CD #DD #BF #D0 #18 #A9 #30 #CD
#18C0 - #DF #30 #31 #D0 #18 #A5 #67 #CD #C5 #BF
#18CA - #30 #28 #D0 #12 #A5 #66 #CD #C6 #BF #30
#18D4 - #1F #30 #9 #A5 #69 #CD #C7 #BF #30 #16
#18DE - #F0 #14 #A5 #68 #8D #C4 #BF #A5 #67 #8D
#18E8 - #C5 #BF #A5 #66 #8D #C6 #BF #A5 #69 #8D
#18F2 - #C7 #BF #60 #63 #A9 #30 #8D #A1 #2 #8D
#18FC - #A0 #2 #8D #9F #2 #A5 #63 #C9 #C0 #F0
#1906 - #26 #A6 #6B #EE #A1 #2 #AD #A1 #2 #C9
#1910 - #3A #D0 #17 #A9 #30 #8D #A1 #2 #EE #A0
#191A - #2 #AD #A0 #2 #C9 #3A #D0 #8 #A9 #30
#1924 - #8D #A0 #2 #EE #9F #2 #CA #D0 #DC #F9
#192E - #30 #3D #80 #BF #8D #B1 #BF #8D #B2 #BF
#1938 - #35 #6D #C9 #00 #F0 #26 #A6 #6D #EE #B2
#1942 - #3F #A0 #B2 #BF #C9 #3A #D0 #17 #A9 #30
#194C - #3D #B2 #BF #EE #B1 #BF #AD #B1 #BF #C9
#1956 - #3A #D0 #8 #A9 #30 #8D #B1 #BF #EE #B0
#1960 - #BF #CA #D0 #DC #AD #A1 #2 #8D #A1 #BF
#196A - #3D #A0 #2 #8D #A0 #BF #AD #9F #2 #8D
#1974 - #9F #BF #60 #63 #A0 #00 #A9 #00 #85 #72
#197E - #A9 #50 #85 #73 #A9 #40 #91 #72 #E6 #72
#1988 - #D0 #2 #E6 #73 #A5 #72 #C9 #40 #D0 #F0
#1992 - #A5 #73 #C9 #BF #D0 #EA #60 #63 #55 #23
#199C - #42 #55 #55 #55 #55 #55 #55 #55 #55 #55
```

LASER

David Ives throws down the gauntlet — it's lasers at dawn in this fight to the death on the ZX-81.

LASER-DUEL IS A two-player game for the ZX-81 where each player is in control of a V-shaped battle machine which he must use to collect gold in the playing area. If a player is shot all his gold is left where he was shot and he is sent back to his corner. The game ends when the time runs out and the winner is the player with the most gold. Controls are with the instructions printed before the game starts.

To enter the game you first need to enter a Rem 1100 characters long to hold the machine code. To enter this Rem first enter:

```
1 REM with 94 0's
```

Then using the edit alter the line number so that lines 1 to 11 are all Rems with 94 0's.

Then enter:

```
12 REM
```

When all these Rem's have been entered type:

```
POKE 16514,118
POKE 16515,118
POKE 16510,0
POKE 16511,78
POKE 16512,4
```

You have now entered the Rem. Next enter listing 1 and type Run. Type in the address where you are going to put the machine code. This will be 16514 unless you have already entered part of the hex. The address is then the first column in the hex dump. Enter each of the lines in the hexadecimal dump except for the address in the first column but include the number at the end of each line as this is a check.

If the message Error please re-enter appears type in the line again as you must have made a typing error. You do not have to enter all the machine code in one go but when you restart the hex loader remember the address will not be 16514. When all the hex has been entered save the program on tape and enter:

```
RAND USR 7527
```

This is to check that the game works. If the game fails to work check the machine code by:

```
RUN 1000
```

As an initial check you can just check the final numbers of each lines. Correct any wrong lines by entering Run and the correct address. When the machine code is working delete all of listing 1 except line 0 and enter listing 2. When all of this has been entered type Run 1000 to save and run the program.

Hex dump

```
16514  17676268412813B821307  763
16524  2FFDFFFFE0000100220021  1025
16534  30020FFFFFFDE2A0C4036  1191
16544  476230620358802310FB0E  889
16554  516ED5B31403E0FA25735  846
16564  576233680230061E1AE63F  725
16574  720043C0310C0D1AE00720  900
16584  30436008180236002 31310  216
16594  3E836802300D20DA367623  919
16604  00620036802310FB367629  895
16614  12A3E1036000ED5B3C401A  700
16624  3FE002500FDCB40FEC93A  1302
16634  34040213440856F7E122A  787
16644  43C40223E40C9CDE8023A  837
16654  54040CB4520013CC84D20  805
16664  5013D66073D404055CB50  080
16674  7203E218C4057E56F4623  815
16684  84E2A3C400922C407EFE  791
16694  9002829FE1B2826FEB428  884
16704  004FE972005FDCB40FEC9  1421
16714  1FE8C2005363002A440E3  700
16724  222444013092A3C4087ED  785
16734  342222C40CB5AC0FDCB43  1232
16744  47EC03A4040F660324340  1059
16754  52A3C40224110C93A4340  710
16764  6CB7FC8218C4057856F46  1216
16774  7234E2A414036C0097EFE  727
```

DUEL

Listing 2.

```
  5 CLS
 10 PRINT "▐▌   ▟▀▀▙ ▟▀▀▀ ▐▛▀▀ ▐▛▀▙ ▐▛▀▙ ▐▌ ▐▌▐▛▀▀▐▌"
 20 PRINT "▐▌   ▐▙▄▟ ▝▀▀▙ ▐▛▀  ▐▛▀▚ ▐▌ ▐▌▐▌ ▐▌▐▛▀ ▐▌"
 30 PRINT "▐▙▄▄ ▐▌ ▐▌ ▄▄▟ ▐▙▄▄ ▐▌ ▐▌ ▐▙▄▛ ▝▙▄▛ ▐▙▄▄▐▙▄▄"
 40 PRINT "████████████████████████████████"
 50 PRINT "▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒"
 60 PRINT " EACH PLAYER HAS A ""V"" SHAPED   BATTLE MACHINE WHICH HE MUST USETO GET AS MUCH GOLD.EACH PLAYER MUST ALSO AVIOD HIS OPPONENT AS"
 70 PRINT "IF YOU GET SHOT THE GOLD YOU     HAVE COLLECTED IS BLOWN FROM YOUIN THE EXPLOSION."
 80 PRINT " KEYS ARE AS BELOW:-"
 90 PRINT ,,"OPPERATION LEFT AND RIGHT PLAYER"
100 PRINT ,,"FIRE          ""1""-""5""   ""6""-""0"""
110 PRINT "MOVE          ""Q""-""T""   ""Y""-""P"""
120 PRINT "ROTATE        ""A""-""G""   ""H""-""█"""
130 PRINT "ROTATE        ""Z""-""V""   ""B""-"" """
140 PRINT ,,"ENTER SPEED 0(FAST)-10(SLOW)"
150 INPUT SPEED
155 IF SPEED<0 OR SPEED>10 OR SPEED<>INT SPEED THEN GOTO 150
160 POKE 17448,250-SPEED
170 POKE 17465,INT (50/(5+SPEED))
180 POKE 17540,INT (50/(5+SPEED))
190 RAND USR 17527
200 FOR A=1 TO 100
210 NEXT A
220 CLS
230 LET L=PEEK 16452+256*PEEK 16453
240 LET R=PEEK 16462+256*PEEK 16463
250 PRINT AT 10,0;"THE FINAL SCORE WAS :-"
260 PRINT ,,"        LEFT PLAYER ";L;"0"
270 PRINT "    RIGHT PLAYER ";R;"0"
280 PRINT ,,,,"      WELL DONE ";
290 IF L>R THEN PRINT "LEFT PLAYER"
300 IF R>L THEN PRINT "RIGHT PLAYER"
310 IF L=R THEN PRINT AT 16,5;"ITS A DRAW"
320 FOR A=1 TO 100
330 NEXT A
340 RUN
1000 SAVE "LASER DUE█"
1010 RUN
9999 REM ████████████████████████████
```

Listing 1.

```
  5 REM **ENTER PROGRAM**
 10 PRINT "ENTER ADDRESS"
 20 INPUT A
 30 INPUT A$
 40 IF A$(1)<>(STR$ A)(4) THEN GOTO 160
 50 LET A$=A$(2 TO )
 60 LET T=0
 70 FOR B=1 TO 10
 80 LET H=16*CODE A$+CODE A$(2)-476
 90 POKE A,H
100 LET T=T+H
110 LET A=A+1
120 LET A$=A$(3 TO )
130 NEXT B
135 PRINT A;" ";A$
140 IF T<>VAL A$ THEN GOTO 160
150 GOTO 30
160 PRINT "ERROR - PLEASE RE-ENTER"
170 GOTO 10
995 REM **CHECK PROGRAM**
1000 PRINT "ENTER START ADDRESS"
1010 INPUT B
1020 FOR A=B TO 17614 STEP 10
1040 PRINT A;" ";(STR$ A)(4);
1050 LET T=0
1060 FOR B=0 TO 9
1070 LET P=PEEK (A+B)
1080 LET T=T+P
1090 PRINT CHR$ (28+INT (P/16));CHR$ (28+P-16*INT (P/16));
1100 NEXT B
1110 PRINT " ";T
1120 NEXT A
```

```
16784 000200C0C01DE24140C9FD 736
16794 9C843BEFE26281CFE6428 1246
16804 018FE122814FE812810FE 1049
16814 13B280CFE822808FE1328 856
16824 204FE072005FDCB4AFEC9 1267
16834 3FE082804FE8C20033697 940
16844 4C9FE972803FEB4C03600 1329
16854 5C93E9C016400B7ED423C 1266
16864 6CB7C28F83D12093E5C01 922
16874 70A00100B7ED4200CB7028 942
16884 8F83D12097DC69C1312C9 1053
16894 92A0C4001070009EB8A44 430
16904 04D0CD07412107001 9EB2A 691
16914 15040CD0741210A0019EB 932
16924 22A4E40CDD741C92ACC40 955
16934 30118037EFEB420023697 827
16944 4FE97200236B42305 78B1 1216
16954 520EDC9FDCB407EC82A3C 1113
16964 6403600020 3E403600FDC0 736
16974 740BE110101AF3253402A 657
16984 8444 07DB4234A2B224440 750
16994 93A5340A22021218A407A 739
17004 0B723231F30F846234E2A 808
17014 13C407B09D20FD7EFE80 1109
17024 220103A5340B23253402A 670
17034 34440232244401806FE00 617
17044 420F3368CCB22AFBA20B9 1284
17054 5'A011C3A5340FEFF20AF 972

17064 62A0C40012300092 2C40 081
17074 7223E403600C92A464036 647
17084 800EDB846401AFE006805 757
17094 9FDCB4AFEC93A4A405184 1346
17104 04085FF7E22A464024 A8 734
17114 140C9CDBB023A4A10CB70 1183
17124 220013CCB75200130E607 744
17134 3324A4055CB6D203E618C 852
17144 44087556F46234E2A4640 802
17154 509224640 7EFE0030CFE 800
17164 61B2808FE842804FE5720 990
17174 705FDCB4AFEC9FE8C2008 1427
17184 836002A4E4023224E4018 473
17194 9092A4640B7ED42224640 839
17204 0CB62C0FDCB407EC03A4A 1476
17214 140F6803240402A464022 839
17224 24B40C93A4D40CB7FC821 1104
17234 38C4087556F46234E2A46 883
17244 440360007EFE0032026036 800
17254 51B224B40C9FDCB4DEEFE 1376
17264 626281CFE842818FE1228 855
17274 714FE812810FE3B28CCFE 1078
17284 8822808FE132804FE0720 738
17294 905FDCB40FEC9FE032004 1286
17304 0FE8C20033697C9FE5728 1280
17314 103FEB4C03600C9FDCB4A 1114
17324 27EC32A464036002A4640 734
17334 33600FDCB1ABE110101AF 989

17344 40253402A4C407DD48044A 000
17354 52B224E403A5340A2202E 551
17364 6218A407AB723231F30F8 940
17374 746234E2A46407B093D20 554
17384 8FC7EFE8020103A53408 2 1191
17394 93253402A4E4023224E40 592
17404 01806FE0020F3368CCB22 990
17414 1AFBA20B216011C3A5340 834
17424 2FEFF20AF2A0C4001F502 1382
17434 3092246402244036 00CD 630
17444 43A3440FEFA20F93EFF32 1326
17454 534403A52403D325240C0 759
17464 63E0A3252402A50402B22 531
17474 750407CB5C0CFFF30B1AA 1578
17484 8AB89809C9C9C9C503080 1192
17494 9919C9C9C9C9050 3C87AE 1528
17504 0ACAD8909C9C9C9C80ED 1547
17514 1580C4013012000214944 393
17524 C8D80C0C0D0C40CD80444C 1450
17534 3C80022B0403E0A325240 515
17544 43EFF324040324A40CD30 919
17554 542CDA943CD7941CD4B43 1245
17564 6CD3D42CDA943CD0A41CD 1258
17574 7E640CDDC42CDB841CD79 1566
17584 841CD4B43CDFE41CD2342 1242
17594 9CD7941CD4B43CD2444C3 1242
17604 098441C1C1C1C1C1C1C1C 112
17614 11C1C1C1C1C7600351330 282
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MAP PLOTTER

John Dawson explains a BBC program to simulate plane tabling, a surveying method, to produce maps and plans.

SATELLITES, LASERS and microelectronics have made big changes to the work of surveyors and map-makers. Measurement of the rate at which glaciers flow and the movement of the Antarctic ice have been largely eliminated by serial Landsat photographs. However, for some jobs the traditional methods of the surveyor are still the best way to approach the problem. Although it is used less in this country than in North America and on the Continent, the plane table is a rugged and effective surveying instrument.

Rathbone, a 16th Century English surveyor, said that the plane table was "A most excellent and absolute instrument for this our purpose in survey." It was used extensively by the British in the Survey of India and has the advantage over other surveying methods that the plan is produced directly with no complicated recording of a multitude of angles and less chance of missing out an important detail.

A flat piece of wood

A plane table consists simply of a flat piece of wood, usually about 20 inches square, mounted on to a tripod to bring it up to a convenient height for the observer. The tripod should have an adjustable head so that the table can be levelled. A sheet of paper is clipped to the top surface of the table and an instrument called an alidade is also necessary. An alidade is simply a ruler with a straight edge and a sight at each end which can be lined up with distant objects that you wish to make on your map.

Figure 1 shows the principle of plane tabling. You must choose a baseline for your survey with an observation point at each end. If you want your map to have a defined scale, for example one inch on the map to represent 100 yards — a scale of 1 in 3600, the two points must be a known distance apart. Either you know this in advance or it can be measured using a long tape measure. Surveyors use steel link chains that are 20 or 30 metres long.

Standing at one observation point, you put the alidade on to the paper fastened to the plane table and place the edge of the ruler so that it runs through the observation point marked on the paper. The alidade is then lined up with an object that you want to record on the map; you draw a line from the observation point to the edge of the paper, and record what the bearing is to. For example, you can write "church" or "end of fence" on the margin of the paper, or simply give the bearing a number and keep a separate record in a notebook.

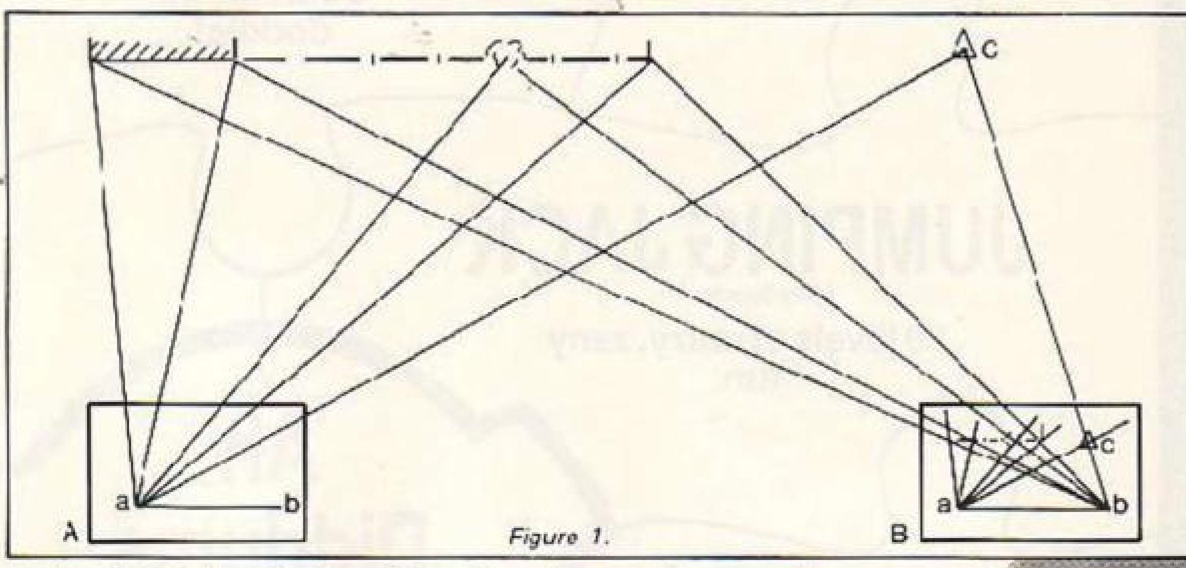
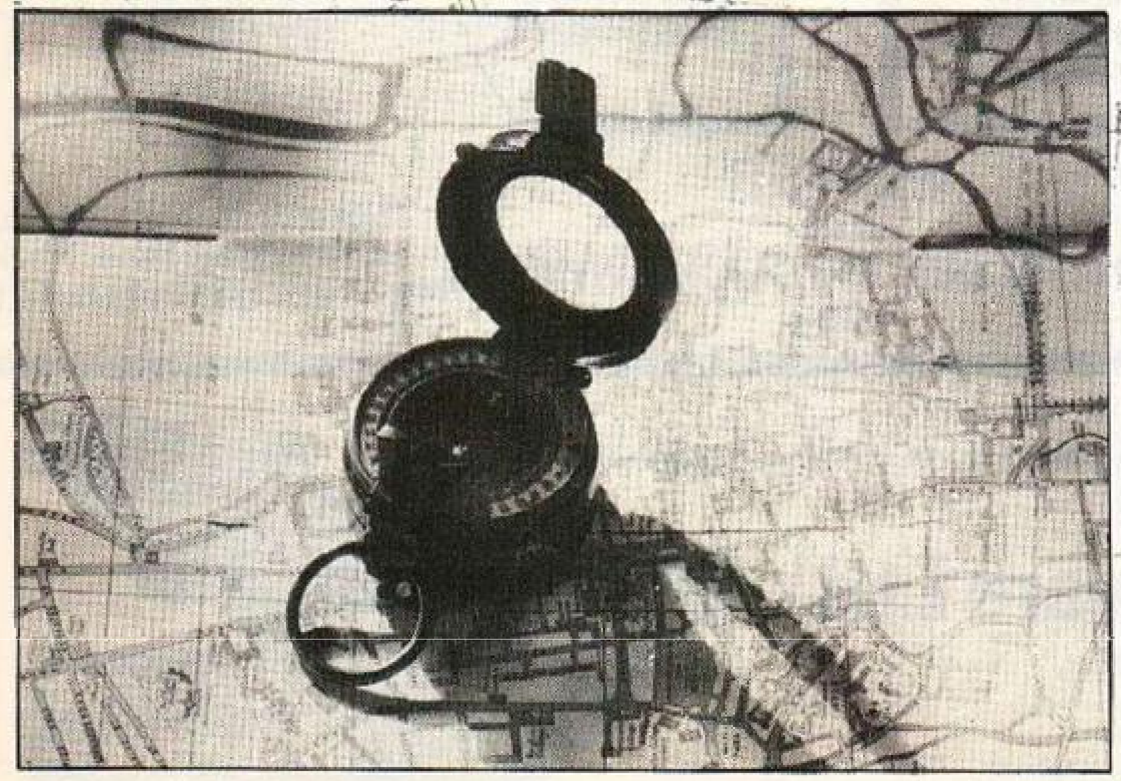


Figure 1.

The first half of the process is now complete. The alidade is turned until it is in line with each of the distant objects and more lines are drawn from the observation point mark to the edge of the paper. Move the plane table to the second observation point and repeat the process for the same objects. The places where the various lines cross on the piece of paper mark the position of the objects. You can see immediately that the scale of the map is set by the length of the baseline on your piece of paper.

If the baseline is short, the distant objects will be closer together and the scale of the map is smaller, for example 1 inch to the mile — 1 in 63360. A further observation point can be chosen and marked by angles from the two original base stations and the process can be continued using one of the original base stations and the new point. In this way the survey can be extended as far as you wish, over hills and through villages or towns.

Below: Figure 2.

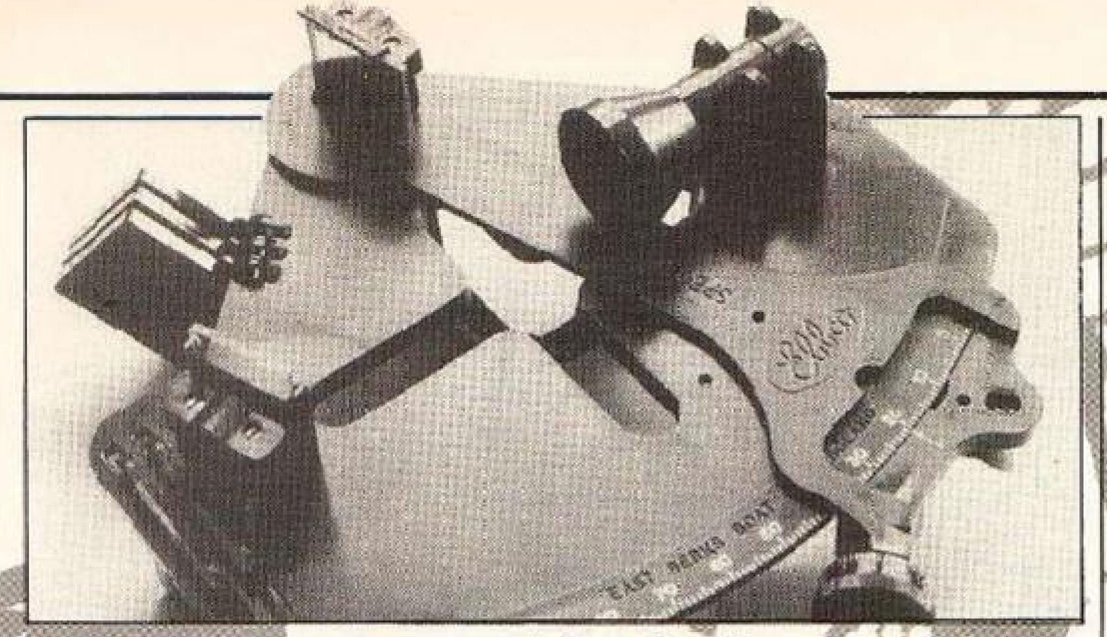


Plane tabling problems

The problems with plane tabling are that the scale of the map is fixed forever once it is committed to paper and work is very difficult in a persistently wet or windy climate.

An alternative method of surveying which is used widely in the United Kingdom consists of measuring a number of distances and angles, and then constructing the plan or map in the relative comfort of the surveyor's office. Theodolites are normally used for measuring horizontal and vertical angles but the two instruments shown in figures 2 and 3 can give useful results.

If you are going to record the data from a survey rather than plotting it on to paper at the time, you will need some way of measuring the position of objects so that their positions can be modelled in your computer. Normally this is done by measuring the angle between two objects, one of which is in a known position. An alternative method which is used for quick reconnaisance sketching makes use of a prismatic compass — figure 2



Above: Figure 3.

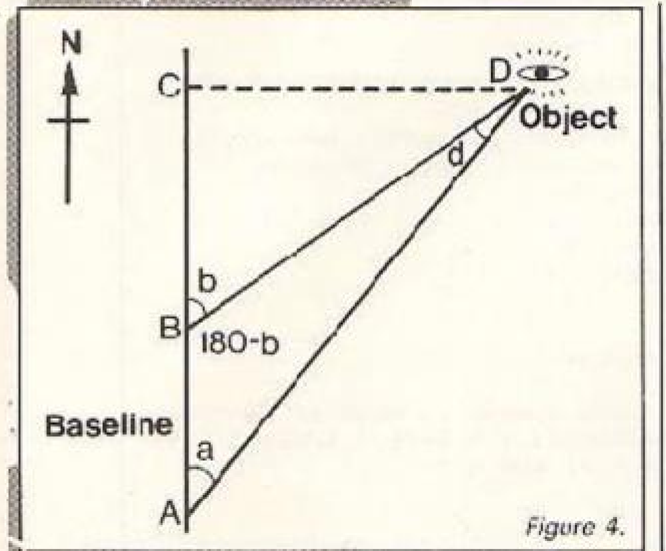


Figure 4.

— to measure the angle between the object and Magnetic North.

The prismatic compass is strongly made and can produce readings accurate to about plus or minus half a degree. The triangular prism at the rear of the compass reflects the image of the edge of the compass card just below the backsight. When the observer looks through the backsight it is possible to line up the hairline on the front glass with an object and take a reading of the bearing at the same time.

The sextant shown in figure 3 is intended for use at sea and is actually made of polycarbonate plastic. This material changes its shape less than brass when the air temperature varies. The vernier scale on the circular drum allows a user to take readings accurate to 0.2 minutes. A minute is 1/60 of a degree.

I can connect either an Epson MX80 FT or an Oric MCP 40 printer to my BBC microcomputer. Using a high resolution dump from the screen to the Epson printer or using the excellent plotting commands in the Oric printer I thought it should be possible to combine the computer with a prismatic compass or a sextant to produce maps or plans like those from a plane table. The advantage would be that they could be plotted automatically and scaled electronically.

From two observation points it is possible to find the height and distance of a far point. Figure 4 shows the simplest arrangement of angles to find the distance of a point from a line extended through the baseline. For the moment I have assumed that the baseline runs in a North/South direction. The baseline is represented by the line A-B in the figure. The formula or algorithm for finding the distance along the line running from point D to point C is:

$$D\text{-}C = \frac{A\text{-}B \, \sin(180\text{-}b) \, . \, \sin a}{\sin d}$$

The angles inside a triangle must add up to 180 degrees so angle d can be found by adding angle a and angle 180-b together and subtracting the result from 180. I have subtracted b from 180 degrees in the formula because the bearing that you measure originally is the acute angle CBD.

The distance C-B can be found using the formula:

$$C\text{-}B = \frac{D\text{-}C}{\tan(b)}$$

When you have these two results it is an easy matter to plot the position of the object by adding the distance B-C to the baseline A-B and using that as the Y co-ordinate, with D-C as the X co-ordinate in a BBC microcomputer Move instruction.

The program consists of the following sections:

Lines 50-80 fill the two dimensional array with dummy values to stop the program having to allocate more space while it is running. OBS$ will be used to hold a series of bearings from two observation points with a short description of the object. Remember that the statement DIM OBS$(2,50) actually sets aside memory for an array three items wide and 51 items deep as both dimensions start from zero in BBC Basic.

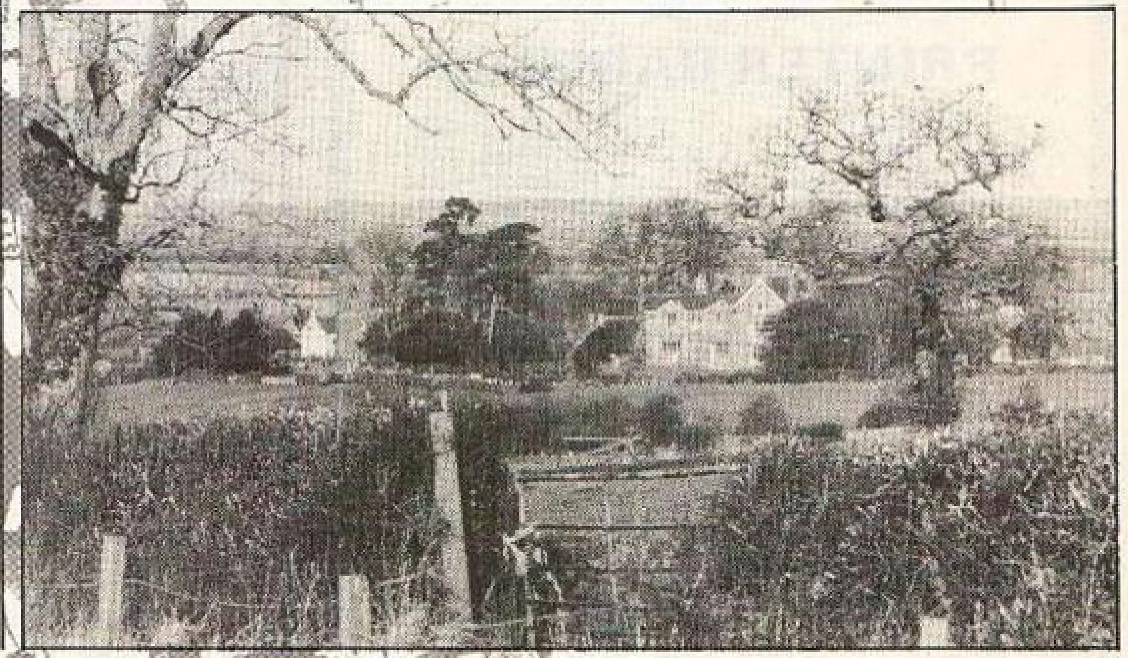
Establishes text window

Line 170 establishes a text window in the bottom three lines of the screen and line 180 sets the graphics origin to the left hand edge of the screen and just above the text window. The largest vertical or Y value that can be displayed on the screen is now 1024-200.

Lines 730-850 are the definition of the initialisation procedure. The Repeat . . . Until loop continues until you have entered the co-ordinates for all the observation points. The purpose of line 790 is to prevent a line being drawn from somewhere off the screen to the first base. After you have entered the first base, the subsequent bases are linked by lines 800 and 810.

Line 300 sets a flag to a known state at the start of the loop before the character typed in by the user is checked and acted upon. PROCangle, lines 390-490, either draws a new bearing on the screen, or clears an existing bearing depending on the state of the gla. PROCclear, lines 950-980, sets the flag to the opposite state and then calls PROCangle to unplot a bearing by plotting it again in the current background colour, line 450.

I will show how the output from the program can be plotted next month using the Oric four colour plotter/printer.



```
10 REM MAP PLOTTING PROGRAM.
20 REM STARTED 29 JANUARY 1984
30
40 DIM OBS$(2,50): DIM BASE(1,10)
50 FOR Z = 0 TO 2
60   FOR ZZ = 0 TO 50
70     OBS$(Z,ZZ) = "******X"
80     NEXT ZZ: NEXT Z
90
100 X = 0: Y = 0: XOR = 0: YOR = 0: D = 1200: BASE
ANGLE = 0
110 BASENO% = 1: BASEE% = 2: B$ = ".."
120
130 MODE 0
140 *KEY 9 "MODE 7 |M LIST |M"
150 *KEY 0 "RUN |M"
160
170 VDU 28,0,31,79,28
180 VDU 29,0;200;
```

(listing continued on next page)

(listing continued from previous page)

```
150
200 PROCinitialise
210
220 REPEAT
230   CLS
240   PRINT "Current base: ";BASENO%;" at ";BASE(0
,BASENO%);",";BASE(1,BASENO%)
250   PRINT "Input <A>ngle <B>ase change <P>rint s
creen <C>lear bearing";
260
270   REPEAT
280     K$ = INKEY$(100)
290     UNTIL K$ <> ""
300   CF = FALSE
310   IF K$ = "A" THEN PROCangle
320   IF K$ = "C" THEN PROCclear
330   IF K$ = "B" THEN PROCbasechange
340   IF K$ = "P" THEN PROCprint
350   UNTIL K$ = "Q"
360 END
370
380
390 DEF PROCangle
400 CLS
410 INPUT "Input angle of bearing: "A
420 Y = D*COS(RAD(A))
430 X = D*SIN(RAD(A))
440 IF CF = FALSE THEN 470 ELSE 450
450 PLOT 3,X,Y
460 GOTO 480
470 PLOT 1,X,Y
480 PLOT 4,XOR,YOR
490 ENDPROC
500
510 DEF PROCorn
520 CLS
530 PRINT "Input X and Y coordinates for base numb
er "; BASENO%,
540 INPUT "X: "X
550 INPUT "Y: "Y
560 PROCcross (X,Y)
570 ENDPROC
580
590 DEF PROCcross (X,Y)
600 B$ = STR$(BASENO%)
610 XOR = X: YOR = Y
620 MOVE XOR-8,YOR
630 DRAW XOR+8,YOR
640 MOVE XOR,YOR+8
650 DRAW XOR,YOR-8
660 MOVE XOR-40,YOR+50
670 VDU 5
680 PRINT B$
690 VDU 4
700 MOVE XOR,YOR
710 ENDPROC
720
730 DEF PROCinitialise
740 CLS
750 INPUT "How many bases ?" BASES%
760 REPEAT
770   PROCorn
780   BASE(0,BASENO%) = X: BASE(1,BASENO%) = Y
790     IF BASENO% = 1 THEN 820
800   MOVE BASE(0,BASENO%-1),BASE(1,BASENO%-1)
810   DRAW BASE(0,BASENO%),BASE(1,BASENO%)
820   BASENO% = BASENO%+1
830   BASES% = BASES%-1
840   UNTIL BASES% = 0
850 BASENO% = BASENO%-1
860 ENDPROC
870
880 DEF PROCbasechange
890 CLS
900 INPUT "Input base number to move to "BASENO%
910 X = BASE(0,BASENO%): Y = BASE(1,BASENO%)
920 MOVE X,Y: XOR = X: YOR = Y
930 ENDPROC
940
950 DEF PROCclear
960 CF = TRUE
970 PROCangle
980 ENDPROC
```

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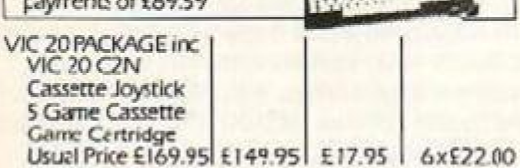
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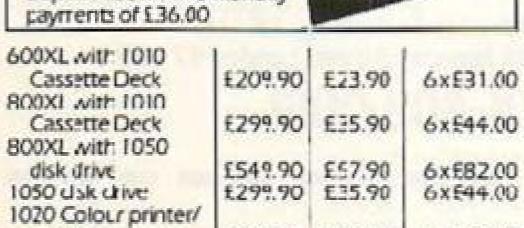
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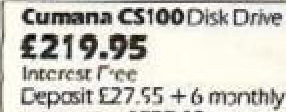
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```
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   4 CLS : CLEAR : PAUSE 20: PRI
NT "Press Y to continue
   Any other key to abandon"
   5 POKE 23658,0
   6 IF INKEY$="" THEN GO TO 6
   7 IF INKEY$<>"y" THEN GO TO 8
000
  10 LET rp=30000
  11 IF rp<30000 THEN PRINT "RP
must be larger than 29999"
  20 INPUT "NUMBER OF PROGRAMS 1
-9 ? ";n
  21 IF n<1 OR n>9 THEN GO TO 20
  22 LET rtop=PEEK PEEK 23732+25
6*PEEK 23733-21*8: LET b=rtop-rp
  25 DIM a(n)
  30 FOR f=1 TO n
  40 PRINT AT 19,0;"BYTES LEFT="
;b;"      "
  50 PRINT AT 20,0;"PROGRAM ";f
  51 RANDOMIZE USR 3582
  55 INPUT "Number of Bytes assi
gned to      program ";(f);" ? ";
y
  60 IF y<200 THEN PRINT £0;"TOO
 FEW BYTES !": PAUSE 50: GO TO 5
5
  70 LET b=b-y: IF b-(n-f)*200<0
 THEN PRINT £0;"Not enough room
for rest of      programs !": PAU
SE 50: LET b=b+y: GO TO 55
  75 PRINT AT 19,0;y;" bytes": R
ANDOMIZE USR 3582: RANDOMIZE USR
 3582
  80 LET a(f)=y: NEXT f
  85 LET tot=30000
  86 LET p=29000
  90 FOR f=1 TO n
 100 LET p=p+12
 101 POKE p-1,INT (tot/256): POK
E p,256*(tot/256-PEEK (p+1))
 110 LET tot=tot+a(f)
 120 NEXT f
 125 LET p=p+12: POKE p+1,INT (r
top/256): POKE p,256*(rtop/256-P
EEK (p+1))
 130 POKE 29154,n
 140 RANDOMIZE USR 29152
8000 INPUT "Prog ? 0-";(PEEK 291
54);" ";a: POKE 23729,a
8010 RANDOMIZE USR 29643: BEEP 0
.2,0: GO TO 8000
9998 SAVE "Prog" LINE 9999: STOP

9999 CLEAR 28999: LOAD ""CODE :
RUN
```

When Clive Sinclair brought out the 1K ZX-81, his first customers found great limitations in its use. The unexpanded ZX-81 had limited memory, crude graphics and a most strange display system, which varied in size. Yet a whole host of impressive software developed for this computer, pushing it to its limits and further. Sinclair's next computer, the Spectrum, had a far more impressive specification but was still lacking in comparison say, to the BBC.

However, programmers have occasionally managed to produce excellent games for the Spectrum showing up even the games-oriented machines such as the Atari. Admittedly, the Spectrum will never quite be in the class of these other more expensive machines but at least by using clever techniques, one can push it toward their level. I hope this routine takes the Spectrum one step nearer.

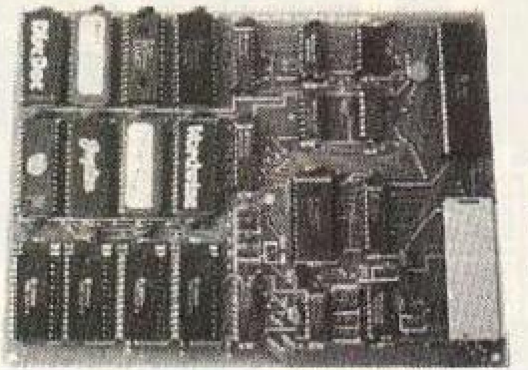
This routine is written to allow the

(continued on page 105)



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Program B.

```
   5 CLEAR 29148
  10 DATA "c32473f30609c578cd327
25e235623e521af15011500edb0e11bc
d2a7213cd2a72cd2a723e801213cd2a7
23e0d12133e801223235e23562b2b2b1
bcd2a72c110c5af32b05c3e06ed47ed5
efbc973237223c93ab05ccb27174717B
016005f21487119c9cd"
  11 DATA 13291
  20 DATA "2f72dd214f5ccd6e72dd2
1575ccd6e72dd21535ccd6e72dd214b5
ccd6e72dd21595ccd6e72dd21b25ccd6
e72c9fdcb4746280b5e235623dd7300d
d7201c9dd5e00dd560173237223c9cd4
072d5ebed5b3d5cafed52223d5c2a4f5
ce53ab15c32b05cfdcb"
  21 DATA 14526
  30 DATA "47c6cd4072d12a515cafe
d52ed5b4f5c1922515c2ab25ced5b3d5
cafed52223d5cd1cd0f73210000226c5
c220b5ccdb0162a3d5c7efe032810232
3ed5bb25c1b1b1b732372fdcb47d63a2
b74feff280332445c3eff322b742a615
c2b22555c210000226e"
  31 DATA 13910
  40 DATA "5caf32705cc9626bafed7
2444d0303ebed5bb25cedb81313ebf9c
9fff3f5c5d5e5dde5fd36470001fe7fe
d781f38751f3872112c743e03cda1743
ae271c630cdbc743a3b5cf5fdcb01dea
f32085ccdbf02f1323b5cfdcb01ae3a0
85cfe50281bfe702817"
  41 DATA 14624
  50 DATA "fe61cad47421e271d6303
8d24604b830cd21b05cbe200e3ab05cf
53e02112c74cda174181232b15cf5cdc
b731f38113e01112c74cda174f1c630c
dbc74cdbe73fdcb475e2008dde1e1d1c
1f1fbc9fbcf0c0601210Cfa2b7cb520f
b10f6c921e271fd3647"
  51 DATA 14100
  60 DATA "003ab15c4604b83818f57
e32b15c112c74afcda174f1c630cdbc7
43e01323a5cc932b15ca718092104002
2425c322b74cd8a723ab15ca7201ffdc
b475628153eeccd810f3e34cd810f3e0
d32085cfdcb01ee1804fdcb47deafc9f
fff2020202020202020"
  61 DATA 13765
  70 DATA "20202020202020204e4f205
35543482050524f472eff20202020202
02020202020202020202020204f2e4b2
02050726f672eff20202020202020202
0202020202020437572726566e7420507
26f672eff413d4e45572d2d503d45534
34150452d2d2d2d5052"
  71 DATA 11448
  80 DATA "4f472e3f20302dff21014
022d07421201822d274cd410c1ae67fc
dbc74131a8730f5c9d52ad074ed4bd27
4cd240b22d074ed43d274d1c91e40031
82ab25c363e2bf92b2b223d5c2a4f5cf
bc33812ed56c9ed5ec9"
  81 DATA 11580
5000 LET c=0: LET f=29149
5010 FOR h=1 TO 8: READ a$
5020 FOR s=1 TO LEN a$ STEP 2
5030 LET a=CODE a$(s): LET b=COD
E a$(s+1)
5040 LET c=c+b+a
5050 IF a>96 THEN LET a=a-39
5060 IF b>96 THEN LET b=b-39
5070 LET a=a-48
5080 LET b=b-48
5090 POKE f,a*16+b
5100 LET f=f+1
5110 NEXT s
5111 PRINT h
5120 READ tot: IF tot<>c THEN PR
INT "Error at line ";h*10: STOP
5125 LET c=0
5130 NEXT h
5131 IF f<>29933 THEN PRINT "wro
ng number of data bytes": STOP
5200 SAVE "code"CODE 29149,800
```

(continued from page 103)

Spectrum programmer the benefit of having up to 10 Basic programs stored in the computer at any one time — a facility normally found only on more expensive machines. Each program is directly accessible by two simple key strokes. Also, jumps to particular lines in different programs can be made from any Basic program. For example you might jump from line 200 of program 4 to line 50 of program 6. Thus program 1 might be used as a menu, calling up games or utilities stored in programs 2-9.

The program is easily stored in the computers: Type in program A and save using line 9998 then type in program B. When this runs error free save the code, after program A on the tape.

When loaded, program A will auto-run picking up the code from program B. You will then be asked how many programs you want 1-9. Having selected a number you will then step through each program deciding how many bytes to allocate. A minimum is 200, the maximum number of bytes is determined by the memory you have free. Once a fixed amount of memory is allocated to each program, it is not possible to change this without deleting all the programs.

Finally you will be asked which program you wish to initially select. Having selected a program, program A will "disappear" leaving you with a blank Basic program ready for your programming. Program A can be recalled at any time by selecting program 0.

If program 0 is selected using keys it will autostart at line 4. If you are sure you will not need to reassign memory to the programs. Incidentally, this has the effect of Newing all the programs other than program 0 at one go. You can New program 0. There is little point though since you have nine other program stores at your disposal.

The multiprogram routine uses the interrupts to check the keys pressed. To change the program you are currently handling simply press Capshift and Break/Space.

You will then be given the following message:



A = NEW P = ESCAPE----- WHICH PROG? X

where X is the number of programs you are handling. Pressing P will bring you back to your current program. Key A will New the current program.

Do not use the Sinclair New command as this may crash the computer. Otherwise selecting a number will exchange your current program with the program selected. All the program variables, current data read position and Microdrive channels of the old program will be saved. It is therefore very easy to hop between programs.

Switching programs

The other way to switch programs is from within a program itself. Use the following method to do this:

Routine C

```
9000 POKE 23619, INT
     (L/256) : POKE 23618,
     INT (256 * (L/256 -
     PEEK 23619))
9010 POKE 29739,S
9020 POKE 23729,P
9030 RAND USR 29643
```

where L = line number to jump to; S = statement number — normally 0 and P = program.

Thus for a menu routine which calls three different programs you might use the following method:

```
10 PRINT "GAME 1"
20 PRINT "GAME 2"
30 PRINT "GAME 3"
40 INPUT "WHICH GAME 1-3 ?" : P
50 LET S = 0 : L = 0
60 GO TO 9000 (Routine C)
```

For those of you who program in machine code it is still possible to have a RAMtop area free for code. Do this by altering the variable RTOP in line 22 of program A.

Different programs occur at different places in memory so the first byte of a line 1 Rem statement is not necessarily 23760.

When using the printer you will need to turn the interrupt routine off. Do this by typing:

RAND USR 29927

Turn it on again by typing:

RAND USR 29930

You can jump between programs with the interrupt routine turned off using Routine C.

The following is a list of subroutines used by the machine code-routine:

Address	Function
29149	Interrupt vector sends interrupt routine here. JP to 29475.
29152	Initialisation routine
29226	Number store routine for above
29231	Calculates address of system variable storage area for each program
29248	Routine to either retrieve or store necessary system variables
29322	Main routine to swop system variables
29455	Routine to move machine stack below new program RAMtop
29475	Interrupt routine — Reads keyboard + check for Capshift, Space/Break — Waits for P, A or number — Calls different routines depending on what is entered
29630	Delay loop
29643	Main routine which calls swop routine 29322 and checks for errors. (If the program number is too high an error message will be given)
29857	Print a string routine
29883	Print a character routine
29927	Int. routine off
29930	Int. routine on

For tape copies of the program please send £2.30 and a stamp addressed envelope to Mark Jones, 17 Park Walk, London SW10 0AS. Please state that you require Multiprogram. ■

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- All entries must arrive at the *Your Computer* offices by the last working day in April 1984.
- Each person may enter the competition only once.
- Entries to the competition cannot be acknowledged.
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SNAPMAN

AFTER SEEING A version of the Pac-Man game in action, I decided to write a version for the Commodore 64, and this is the result.

David Rees gets to grips with the grizzly ghosts.

Graphics are very extensive. There are two different mazes produced from user-defined graphics, containing pills and power pills, each worth 10 points. Also, at random intervals, fruit appears beneath the ghosts' lair, and can either be a cherry — 100 points, strawberry — 500 points, or the Commodore logo — 1000 points. There are four multi-colour ghosts with mobile eyes and edible bodies, and one Snapman.

Movement of the Snapman is controlled by a joystick — port one — or the keyboard. Ghosts have the logic for angry, fearful, random or homeward motion, and move at half speed after you eat a power pill. They flash white when they are about to return to normal. They can also hide beneath one another to confuse you.

The Snapman scenario

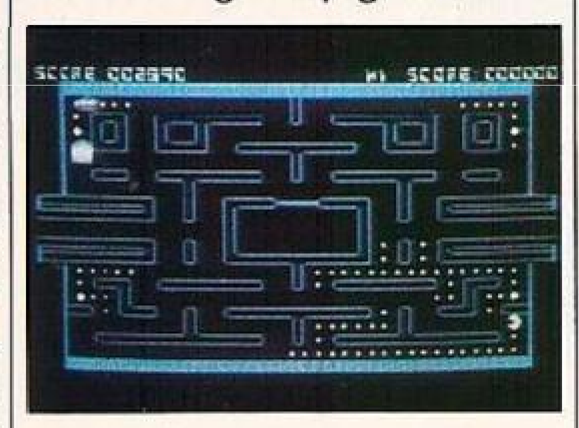
If the details above have persuaded you that the game is worthwhile, here is its scenario: You are a little hungry Snapman, lost in the food maze. To keep going you must eat the pills and fruit of the maze, while at the same time avoiding the angry ghost monsters, whose touch means death. However, you do have a weapon against them. They become edible when they turn blue after you have eaten a large power pill — ghost scores are 1st: 200; 2nd: 400; 3rd: 800; 4th: 1600. After all the pills in one maze have been eaten, you escape to a new and faster maze. This continues until all your three lives are lost.

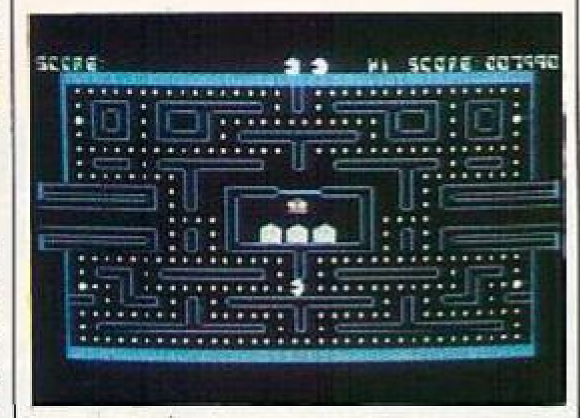
Snapman comes in two parts, a Basic section to handle registers, the maze and scoring, and a code section which stores graphics and the main game. The code is loaded as a set of hexadecimal numbers.

To help with entering the code, I have included a third program. If you Run it, you can start at any point along the code and enter the numbers. After you have finished, use

RUN 700

This will display totals of numbers in the sections of memory, and the correct totals. If these do not agree, there is an incorrect





number in that section of memory. You can then use

RUN 900

This gives a screen listing from any point along the code, in the same format as the magazine listing, and you can use it to find the mistake.

After the mistake has been found, you can use the first input routine to correct it. Finally, when you think that all the code is correct, you can save it directly after the Snapman Basic program on the tape by using

RUN 11C0

It is best to save the code after the Basic, because the program loads the code shortly after you have Run it.

If there is still something wrong with the code after it has been saved, use the Basic Snapman program to Load the code, stop the Basic, Load the input program, and carry on as if you had found a mistake as above.

My highest score on the standard game is 224640. However, if you want to make it harder — or easier — for yourself, it is fairly easy to change the format of the game for your own use.

L gives the number of lives that you have left. Although only a maximum of two lives are displayed on the screen, L can be any number in the floating point range. Also, in line 540, the Stop and Restore keys are disabled, to stop anyone from ruining the game just when you are reaching a record score. If you want to be able to stop the game, simply change the number at the end of the line to 255.

TD is another important variable, controlling the speed of the main program, with a normal value of 2048. However, if the start speed is too fast all you have to do is increase TD, and for a more challenging game, simply reduce TD. For the fastest game possible, TD should equal zero, where the speed will be 300 moves per second. Also, if you want the speed to increase at a different rate, simply change the number 100 in line 5110.

Loading graphics into RAM

SC controls the type of maze used, so if you want to use only the big maze or the small maze, keep SC constant by changing line 5120. By varying this line, mazes can appear in any order, and by changing lines 860-900, provision can be made for more mazes to be added in the gap between 2000 and 4899.

Care does have to be taken with one section of the program, lines 45 to 95. This loads normal graphics into RAM. To do this, Input/Output memory has to be switched out of main memory. This means that functions, like key input, must be switched off, so if there is an error in this section of program, there is no way to restart the computer, except by switching it off and then on.

Finally, if the program seems too long to type in, and you would prefer to receive it on a C15 cassette, send your name, address, and £3 to: David Rees, The Georgian House, Brooks Close, Weybridge, Surrey KT13 0LX.

Hex loader.

```
1 REM******************
2 REM*HEX CODE INPUT*
3 REM*   PROGRAM    *
4 REM*  INCLUDING   *
5 REM* ROUTINES FOR *
6 REM*CHECKS +SAVING*
7 REM*      BY      *
8 REM*  DAVID REES  *
9 REM******************
10 REM*ENTER NUMBERS*
11 GOSUB500
15 POKE52,55:POKE56,55:GOTO200
20 B=0:K=14*1024:J=20591
30 INPUT"START POSITION",A$
40 IFLEN(A$)<>4THEN30
50 FORN=1TO4
60 B$=MID$(A$,N,1)
70 FORM=0TO15
80 IFB$=A$(M)THEN110
90 NEXTM
100 GOTO40
110 B=B+(2↑(4*(4-N)))*M
120 NEXTN
130 IFB<KORB>JTHEN20
140 RETURN
200 GOSUB20
210 GOSUB600:PRINTB$;
220 GOSUB550:IFN=16THEN220
230 C=N*16:PRINTA$;
240 GOSUB550:IFN=16THEN240
250 POKEB,C+N:B=B+1:PRINTA$
340 IFB<J+1THEN210
350 END
500 DIMA$(15)
510 FORN=0TO9:A$(N)=RIGHT$(STR$(N),1):NEXT
520 FORN=10TO15:A$(N)=CHR$(N+55):NEXT
530 RETURN
550 GETA$:IFA$=""THEN550
560 FORN=0TO15:IFA$=A$(N)THENRETURN
570 NEXT
580 N=16:RETURN
600 C=BAND15:D=(BAND240)/16
610 E=(BAND3840)/256:F=(BAND28672)/4096
620 B$=A$(F)+A$(E)+A$(D)+A$(C)
630 RETURN
699 REM*CHECKSUMS*
700 M$(0)="3800":M(0)=14336:M$(1)="3B00"
710 M(1)=15104:M$(2)="4000":M(2)=16384
720 M$(3)="4400":M(3)=17408:M$(4)="4800"
730 M(4)=18432:M$(5)="4B00":M(5)=19200
740 M$(6)="5000":M(6)=20480:M$(7)="50D3"
750 M(7)=20691
760 T(0)=67588:T(1)=83622
770 T(2)=107791:T(3)=114244
780 T(4)=99513:T(5)=135890
790 T(6)=22370
800 FORN=0TO6
810 T=0:A=M(N):B=M(N+1)
820 FORM=ATOB:T=T+PEEK(M):NEXT
830 PRINTM$(N)" TO "M$(N+1)
840 PRINT" CORRECT="T(N),"ACTUALLY="T
850 NEXTN
899 REM*PEEK CHECK*
900 GOSUB500:GOSUB20
910 I=BAND32760
920 GOSUB600
930 FORM=0TO7
940 P=PEEK(I+M):Q=PAND15:R=(PAND240)/16
```

(Hex loader continued on page 111)

(Hex loader continued from page 109)

```
950 B$=B$+" "+A$(R)+A$(Q)
960 NEXTN
970 PRINTB$:B=B+8
980 IFB>J+8THENEND
990 GETF$:IFA$=""THEN990
1000 GOTO920
1099 REM*SAVE*
1100 FORN=0TO35
1110 READA:POKE42704+N,A
1120 NEXTN
1130 SYS40704
1200 DATA169,56,133,252,169,81,133,254
1210 DATA169,,133,251,133,253
1220 DATA162,1,160,255,32,186,255
1230 DATA169,0,32,189,255,169,251
1240 DATA166,253,164,254,32,216,255,96
```

Basic program.

```
5 H$="000000"
10 V=53248:DIM S(99)
20 POKEV+32,0:POKEV+33,0
30 PRINT"[illegible]"
40 PRINTCHR$(142)
45 POKE56334,PEEK(56334)AND254
50 POKE1,PEEK(1)AND251
55 FORI=0TO511:POKEI+12288,PEEK(I+53248):NEXTI
60 FORN=0TO4:READA:FORB=0TO15
65 POKE12576+I*8[illegible],PEEK(53248+A*8+B*2)
70 NEXTN,I
75 FORI=0TO,READA:FORN=0TO7
80 POKE12656+I*8+N,PEEK(53248+A*8+N)
85 NEXTN,I
90 DATA15,14,1,11,15,95,105
95 POKE1,PEEK(1)OR4:POKE56334,PEEK(56334)OR1
100 POKEV+21,0
110 POKE51,0:POKE52,51
120 POKE55,0:POKE56,44
130 FORN=0TO19
140 READA:POKE33936+N,A
150 NEXTN
160 DATA162,1,160,255,32,186,255
170 DATA169,,32,189,255,162,255,169,188
180 DATA62,213,255,96
185 FORN=0TO62:READD(X):NEXT
190 FORN=0TO5:READD(X):NEXTN
200 PRINT"LOADING DATA"
210 SYS39936
220 POKE14650,24:POKE14653,60:POKE14660,60:POKE14668,24
230 POKEV+24,29:POKEV+35,6:POKEV+17,PEEK(V+17)AND64:POKEV+36,2
251 PRINT"[illegible]":POKE56322,255
252 PRINTTAB(13)"[illegible]"
253 PRINTTAB(13)"[illegible]"
255 PRINT"[illegible]";TAB(14)"BY DAVID REES"
257 PRINT"[illegible] YOU REQUIRE JOYSTICK OR KEYBOARD USE"
258 LF$="[illegible]":L=2:LL=0
259 SC=0:TD=2040
260 INPUTA$:IFA$="J"THENPOKE913,1:GOTO297
270 IFA$<>"K"THENPRINT"INPUT 'K' OR 'J' PLEASE":GOTO260
280 PRINT"KEYS":POKE913,0:POKE14276,0
290 PRINT"LEFT: Z RIGHT: X"
295 PRINT"UP : F5 DOWN : F7"
297 PRINT"PRESS ANY KEY TO CONTINUE"
298 GETA$:IFA$=""THEN298
310 F=0:L=2:HS=0
330 POKEV+21,31
340 FORN=0TO11:POKE[illegible],0:NEXT
370 S=54272:POKES+24,15
380 POKES+14,255:POKES+15,255
390 POKES+18,129
500 POKE875,0:POKE876,0
510 POKE877,0:POKE878,0
520 POKE859,0:POKE860,2
530 POKE861,2:POKE862,2
540 POKE863,2:POKE56322,127
550 POKE886,2
560 POKE931,0:POKE932,16
570 POKE917,0:POKE916,0:POKE918,0
580 POKEV+39,7
590 FORN=0TO3:POKEV+40+N,N+2:NEXT
600 POKE2040,247:POKE2041,242
610 POKE2042,242:POKE2043,242
620 POKE2044,242
630 POKEV+28,30
640 POKEV+37,0:POKEV+38,1
650 FORN=0TO3:POKEN+929,5:NEXT
660 POKE926,0
690 POKEV+31,0
730 POKE917,0
750 POKE841,0
800 POKE924+[illegible]
810 POKE97+256*79,73
820 POKE113+79*256,254
830 POKE20616,144
850 POKE94+56*256,24
860 IFLL=0THEN[illegible]
870 [illegible]
880 GOTO1300
900 IF(SC AND 1)=1THEN1500
1000 PRINT"[illegible]"
1020-1229 PRINT"[illegible]"
1300 POKE937,14:POKE938,1
1310 POKE914,147:POKE915,5
1320 POKE927,121:POKE928,146
1330 POKE929,140:POKE930,202
1340 POKE926,113
1350 POKEV,177:POKEV+1,177
1360 POKEV+2,175:POKEV+3,129
1365 POKEV+4,159:POKEV+5,145
1370 POKEV+6,175:POKEV+7,145
1375 POKEV+8,191:POKEV+9,145
1390 GOTO4900
1500 PRINT"[illegible]"
1520-1750 PRINT"[illegible]"
1760 POKE2023,31:POKE56295,6
1800 POKE937,92:POKE903,1
1810 POKE914,18:POKE915,6
1820 POKE927,139:POKE928,154
1830 POKE929,139:POKE930,214
1840 POKE926,123
1850 POKEV,177:POKEV+1,185
1860 POKEV+2,175:POKEV+3,137
1865 POKEV+4,159:POKEV+5,153
1870 POKEV+6,175:POKEV+7,153
1875 POKEV+8,191:POKEV+9,153
4900 PRINT"[illegible]"TAB(24)[illegible]TAB(19)LF$
4910 POKEV+21,31:POKEV+17,PEEK(V+17)AND191
4920 IFLL=0THENPOKE875,0:POKE876,0
4950 IFSC>=[illegible]THEN[illegible]
5000 T=INT(TD/256):POKE952,T:POKE951,TD-256*T
5001 POKEV+21,31:LL=0
5002 X=PEEK(30+V):POKE54283,0
5010 SYS20016
5030 X=PEEK(780)
5040 IFX=128THEN5100
5050 IFX=255THEN[illegible]
5060 END
5070 GOTO5010
5100 FORN=71TO7STEP-0.2:POKEV+35,N:NEXTN
5110 TD=TD-100:IFTD<1THENTD=1
5120 SC=SC+1
5180 PRINT"[illegible]":POKEV+21,0:POKE54296,0
5190 GOTO510
5200 L=L-1:IFL=0THENLF$="":GOTO5220
5210 LF$="[illegible]"
5220 S=54272:POKES+24,15:LL=1
5230 POKES+5,63:POKES+6,129:N=70
5240 POKES,0:POKES+1,N:POKES+4,17
5250 FORT=0TO20:NEXTT
5260 POKES+4,0
5270 N=N/1.09:IFN>10THEN5240
5280 POKES+1,0
5400 IFL=1THENPOKE54296,0:GOTO6000
5410 GOTO510
6000 S$="":FORN=0TO5
6010 X=PEEK(1030+N):S$=S$+CHR$(X)
6020 NEXTN
6025 POKE54296,0
6030 S=VAL(S$):PRINT"[illegible]":POKEV+21,0
6040 FORN=0TO5
6050 IFS>A(N)THEN6080
6060 NEXTN
6070 GOTO7000
6080 FORM=5TONSTEP-1
6090 A$(M+1)=A$(M):A(M+1)=A(M)
6100 NEXTM
6110 A(N)=S:K=N
6120 PRINT"[illegible]":POKEV+24,29:POKEV+17,PEEK(V+17)OR64
6130 POKEV+34,7:POKEV+35,2:POKEV+36,0
6140 X=7:PRINTTAB(X)"[illegible]"
6150 PRINTTAB(X)"[illegible]"
6153 PRINT"[illegible] PLEASE ENTER YOUR NAME AND PRESS"
6157 PRINTTAB(17)"[illegible]"
6160 PRINT"[illegible]"TAB(X)"[illegible]"
6170 PRINTTAB(X)"[illegible]"
6180 PRINTTAB(X)"[illegible]"
6190 C=0
6195 FORN=0TO10:GETA$:NEXTN
6200 SYS15360
6210 A=PEEK(2):IFA=20THEN6300
6220 IFA=13THEN6500
6230 IFA<32OR(A>95)THEN6200
6240 IFA<48AND(A>57)THEN6200
6250 IFA>63THENA=A-64
6260 POKE1396+C,A-64:C=(C+1)AND15
6270 GOTO6200
6300 C=(C-1)AND15:POKE1396+C,96:GOTO6200
6500 A$="":FORN=0TO15
6510 X=PEEK(1396+N)-64:IFX<32THENX=X+64
6520 A$=A$+CHR$(X)
6530 NEXTN
6540 A$(K)=A$:GOTO7000
7000 PRINT"[illegible]":X=4
7010 POKEV+24,29
7020 POKEV+17,PEEK(V+17)OR64
7030 POKEV+34,5:POKEV+35,6
7040 PRINTTAB(X)"[illegible]"
7050 PRINTTAB(X)"[illegible]"
7060 PRINTTAB(X)"[illegible]"
7070 FORN=0TO5
7080 PRINT"[illegible]"(N+1)" "A$(N):PRINT"[illegible]",,"[illegible]"A(N)"[illegible]"
7090 NEXTN
7100 PRINT"[illegible]"
7110 GETA$
7120 X=PEEK(V+35):IFX=246THENPOKEV+35,2:GOTO7140
7130 POKEV+35,6
7140 [illegible]
7150 PRINT"[illegible]"
7160 POKEV+17,PEEK(V+17)AND191
7170 H$=STR$(A(0))
7180 L=LEN(H$):H$=RIGHT$(H$,L-1)
7190 A$="":IFL-1=6THEN7240
7200 FORN=L-1TO5
7210 A$=A$+"0"
7220 NEXT
7230 H$=A$+H$:PRINT"[illegible]"
7240 GOTO250
8000 DATA50,4,50,50,11,50,50,12,50
8010 DATA70,4,50,70,11,50,70,12,50,,100
8020 DATA50,6,50,50,11,50,50,14,50
8030 DATA70,6,50,70,11,50,70,14,50,,100
8040 DATA50,4,50,50,11,50,50,12,50
8050 DATA70,4,50,70,11,50,70,12,50,,100
8060 DATA,14,,15,,16
10000 S=54272:POKES+24,15
10010 POKES+5,9:POKES+6,0
10020 FORN=0TO5STEP3
10030 POKES,1(N):POKES+1,S(N+1):POKES+4,33
10040 FORT=0TOS(N+2):NEXTT
10050 POKES+4,0:NEXTN
10060 [illegible]
10070 POKES+4,33
10080 FORI=0TO15
10090 POKES,I(N)+I*2:POKES+1,B(N+1)
10100 NEXTI
10110 POKES+4,0:FORT=0TO5:NEXTT,N
10120 RETURN
```

Hex code dump.

3300	00	00	00	18	18	00	00	00
3308	FF	FF	FF	FF	FF	FF	FF	00
3310	FF	FF	FF	FF	FF	FF	FF	0C
3318	FF	FF	FF	FF	FF	FF	FF	30
3320	FF	FF	FF	FF	FF	FF	FF	F0
3328	FF	FF	FF	FF	FF	FF	FF	0F
3330	00	07	0C	0C	0C	0C	0C	0C
3338	F0	F0	F0	F0	F0	F0	F0	F0
3340	0F	0F	0F	0F	0F	0F	0F	0F
3848	00	FF	00	00	00	00	FF	00
3850	00	FF	00	00	00	00	0F	30
3858	00	FF	00	00	00	00	F0	0C
3860	00	E0	30	30	30	30	30	30
3868	0C	0C	0C	0C	0C	0C	0C	0C
3870	30	30	30	30	30	30	30	30
3878	0C	0C	0C	0C	0C	0C	07	00
3880	30	0F	00	00	00	00	FF	00
3AAA	0C	F0	00	00	00	00	FF	00
3890	30	30	30	30	30	30	E0	00
3898	00	07	0C	0C	0C	0C	07	00
38A0	00	E0	30	30	30	30	E0	00
38A8	F0	FF	F0	FA	FA	FA	FF	FA
38B0	F0	FF	00	00	00	00	FF	00
38B8	00	E0	30	:F	1F	30	E0	00
38C0	00	00	00	FF	FF	00	00	00
38C8	00	07	0C	F0	F0	0C	07	00
38D0	0F	FF	0F	0F	0F	0F	FF	0F
38D8	0F	FF	01	01	01	01	FF	00
38E0	00	FF	80	80	80	80	FF	F0
38E8	00	FF	01	01	01	01	FF	0F
38F0	F0	FF	FF	FF	FF	FF	FF	FF
38F8	00	FF	FF	FF	FF	FF	FF	FF
3900	00	00	00	00	00	00	00	00
3908	0F	FF	FF	FF	FF	FF	FF	FF
3910	00	00	00	00	00	00	00	00
3918	3E	20	20	3E	03	03	3F	00
3920	3E	20	20	20	30	30	3E	00
3928	3E	22	22	22	32	32	3E	00
3930	3E	22	22	3C	24	32	32	00
3938	3E	20	20	3E	30	30	3E	00
3940	00	00	13	3C	3C	18	00	00
3948	00	01	02	02	0C	1E	1A	0C
3950	40	80	80	40	30	78	68	30
3958	01	07	0F	0F	07	07	03	01
3960	80	E0	50	30	E0	60	C0	80

3968	03	0F	1C	18	18	1C	0F	03
3970	00	00	E0	C0	C0	E0	00	00
3978	00	00	00	00	00	00	00	00
3980	7E	42	42	62	62	52	7E	00
3988	10	10	10	18	18	18	18	00
3990	7E	02	02	7E	60	50	7E	00
3998	7E	02	02	7E	06	06	7E	00
39A0	48	48	48	7E	18	18	18	00
39A8	7E	40	40	7E	06	06	7E	00
39B0	40	40	40	7E	62	52	7E	00
39B8	7E	02	02	02	06	06	06	00
39C0	7E	42	42	7E	46	46	7E	00
39C8	7E	42	42	7E	06	06	06	00
39D0	00	00	18	00	00	18	00	00
39D8	1C	7F	FF	1F	07	1F	FF	7E
39E0	00	00	00	00	00	30	00	00
39E8	F5	F6	F7	F6	F5	F8	F9	F8
39F0	F5	FA	FB	FA	F5	FC	FD	FC
39F8	F7	F7	F7	F7	00	00	7F	7F
3A00	22	22	22	3E	32	32	32	00
3A08	7F	7F	00	00	7F	7F	00	00
3A10	FF	FF	00	00	FF	FF	00	00
3A18	7F	7F	00	00	7F	7F	00	00
3A20	FF	FF	00	00	FF	FF	00	00
3A28	7F	7F	00	00	7F	7F	00	00
3A30	FF	FF	00	00	FF	FF	00	00
3A38	7F	7F	00	00	7F	7F	00	00
3A40	CD	A8	03	F0	06	8D	A9	03
3A48	18	90	27	8D	FB	03	C9	00
3A50	F0	06	29	02	C9	00	D0	0D
3A58	AD	9C	03	18	69	02	18	8D
3A60	A9	03	18	90	D6	AD	9A	03
3A68	8D	A9	03	49	01	18	8D	AC
3A70	03	60	C9	00	F0	06	29	02
3A78	C9	00	D0	0D	FD	9C	03	18
3A80	69	02	18	8D	FB	03	18	90
3A88	06	AD	9A	03	ED	AB	03	49
3A90	01	18	8D	AC	03	60	00	00
3A98	7F	7F	00	00	7F	7F	00	00
3AA0	FF	FF	00	00	FF	FF	00	00
3AA8	7F	7F	00	00	7F	7F	00	00
3AB0	FF	FF	00	00	FF	FF	00	00
3AB8	7F	7F	00	00	7F	7F	00	00
3AC0	8D	A9	03	49	01	18	8D	AD
3AC8	03	C9	00	F0	06	29	02	C9
3AD0	00	D0	0D	AD	5C	03	18	69
3AD8	02	18	8D	AA	03	18	90	06

3AE0	A9	9A	03	8D	AA	03	CD	A8
3AE8	03	F0	01	60	8D	A8	03	A4
3AF0	02	B9	5C	03	8D	A9	03	AD
3AF8	A8	03	49	01	18	8D	AC	03
3B00	A9	FF	60	FF	00	00	FF	FF
3B08	80	80	FF	FF	80	80	FF	FF
3B10	00	00	FF	FF	00	00	FF	FF
3B18	80	80	FF	FF	80	80	FF	FF
3B20	00	00	FF	FF	00	00	FF	FF
3B28	80	80	FF	FF	80	80	FF	FF
3B30	00	00	FF	FF	00	00	FF	FF
3B38	80	80	FF	FF	80	80	FF	FF
3B40	A9	FF	8D	02	DC	20	9F	FF
3B48	20	E4	FF	85	02	A9	7F	8D
3B50	02	DC	60	FF	00	00	FF	FF
3B58	80	80	FF	FF	80	80	FF	FF
3B60	00	00	FF	FF	00	00	FF	FF
3B68	80	80	FF	FF	80	80	FF	FF
3B70	00	00	FF	FF	00	00	FF	FF
3B78	80	80	FF	FF	80	80	FF	FF
3B80	00	00	FF	FF	00	00	FF	FF
3B88	80	80	FF	FF	80	80	FF	FF
3B90	00	00	FF	FF	00	00	FF	FF
3B98	80	80	FF	FF	80	80	FF	FF
3BA0	00	00	FF	FF	00	00	FF	FF
3BA8	80	80	FF	FF	80	80	FF	FF
3BB0	00	00	FF	FF	00	00	FF	FF
3BB8	80	80	FF	FF	80	80	FF	FF
3BC0	00	00	FF	FF	00	00	FF	FF
3BC8	A5	80	FF	FF	80	80	FF	FF
3BD0	00	00	FF	FF	00	00	FF	FF
3BD8	80	80	FF	FF	80	80	FF	FF
3BE0	00	00	FF	FF	00	00	FF	FF
3BE8	80	80	FF	FF	80	80	FF	FF
3BF0	00	00	FF	FF	00	00	FF	FF
3BF8	80	80	FF	FF	80	80	FF	FF
3C00	0A	80	00	2A	A0	00	AA	A8
3C08	00	BE	F8	00	9E	78	00	AA
3C10	A8	00	AA	A8	02	AA	A8	00
3C18	AA	A8	00	88	8E	00	00	00
3C20	00	00	00	00	00	00	00	00
3C28	00	00	00	00	00	00	00	00
3C30	00	00	00	00	00	00	00	00
3C38	00	00	00	00	00	00	00	00
3C40	0A	80	00	2A	A0	00	AA	A8

(Hex dump continued on next page)

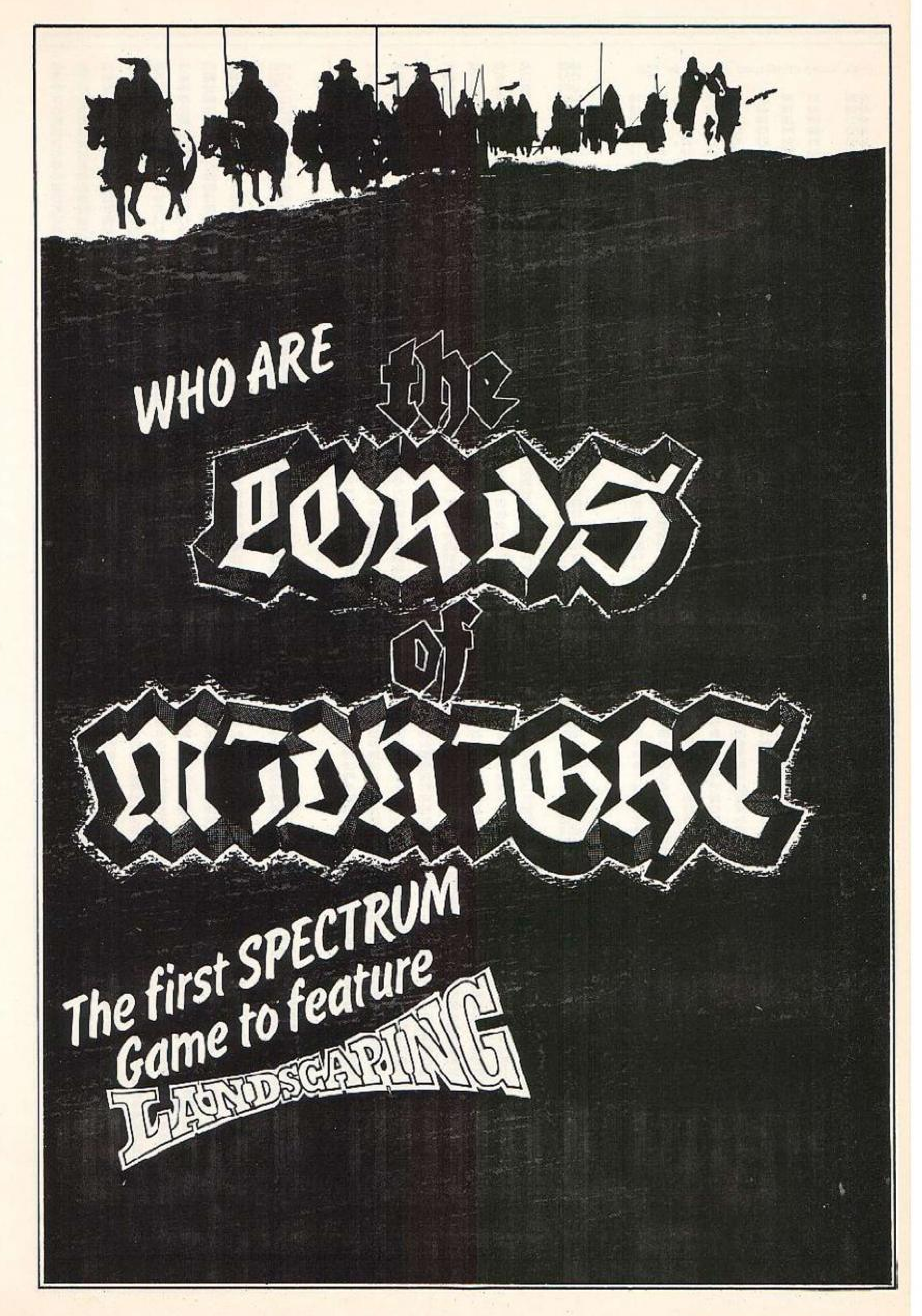
(Hex dump continued from previous page)

3C48	00	BE	F9	00	B6	D0	00	AA
3C50	A8	00	AA	A8	00	AF	AB	00
3C58	AA	A8	00	88	88	00	00	00
3C60	00	00	03	00	00	00	00	30
3C68	00	00	03	00	00	00	00	00
3C70	00	00	03	00	00	00	00	00
3C78	00	00	03	00	00	00	00	30
3C80	0A	80	03	2A	A0	00	AA	A8
3C88	00	B6	73	00	BE	F8	00	AA
3C90	A8	00	AA	A8	00	AF	A8	30
3C98	AA	A8	03	88	88	00	00	30
3CA0	00	00	03	00	00	00	00	30
3CA8	00	00	03	00	00	00	00	30
3CB0	00	00	03	00	00	00	00	30
3CB8	00	00	03	00	00	00	03	30
3CC0	0A	80	00	2A	A0	00	AA	A8
3CC8	00	BE	F8	00	B6	7E	03	AA
3CD0	A8	00	AA	A8	00	AF	AB	30
3CD8	AA	A8	00	88	88	00	03	30
3CE0	00	00	00	00	0A	A0	AA	AA
3CE8	00	00	00	00	00	00	03	30
3CF0	00	00	00	00	00	00	03	30
3CF8	00	00	00	00	00	00	03	30
3D00	0A	80	00	2A	A0	00	AA	A8
3D08	00	BA	B8	00	BA	B8	03	AA
3D10	A8	00	AE	E8	00	BB	B3	00
3D18	AA	A8	00	88	88	00	03	30
3D20	00	00	00	00	00	00	03	00
3D28	00	00	00	00	00	00	03	00
3D30	00	00	00	00	00	00	03	00
3D38	00	00	00	00	00	00	03	00
3D40	1C	00	00	7F	00	00	7F	00
3D48	00	FF	80	00	FF	80	03	FF
3D50	80	00	7F	00	00	7F	03	00
3D58	1C	00	00	00	00	00	03	00
3D60	00	00	00	00	00	00	00	00
3D68	00	00	00	00	00	00	00	00
3D70	00	00	00	00	00	00	00	00
3D78	00	00	00	00	0A	AA	AA	00
3D80	1C	00	00	7F	00	00	7F	00
3D88	00	FF	80	00	1F	80	00	FF
3D90	80	00	7F	00	00	7F	00	00
3D98	1C	00	00	00	00	00	00	00
3DA0	00	00	00	00	00	00	00	00
3DA8	00	00	00	00	00	00	00	00
3DB0	00	00	00	00	00	00	00	00
3DB8	00	00	00	00	00	00	00	00
3DC0	1C	00	00	7F	00	00	FF	00
3DC8	30	1F	80	00	07	80	00	1F
3DD0	30	00	FF	00	00	7F	00	00
3DD8	1C	00	00	00	00	00	00	00
3DE0	30	00	00	00	00	00	00	00
3DE8	30	00	00	00	00	00	00	00
3DF0	30	00	00	00	00	00	00	00
3DF8	30	00	00	00	00	00	00	00
3E00	1C	00	00	7F	00	00	7F	00
3E08	30	FF	80	00	FC	00	00	FF
3E10	30	00	7F	00	00	7F	00	00
3E18	1C	00	00	00	00	00	00	00
3E20	30	00	00	00	00	00	00	00
3E28	30	00	00	00	00	00	00	00
3E30	00	00	00	00	00	00	00	00
3E38	00	00	00	00	00	00	00	00
3E40	1C	00	00	7F	00	00	7F	E0
3E48	00	FC	00	00	F0	00	00	FC
3E50	00	00	7F	00	30	7F	00	C0
3E58	1C	00	00	00	30	00	00	00
3E60	00	00	00	00	30	00	00	00
3E68	00	00	00	00	30	00	00	00
3E70	00	00	00	00	30	00	00	00
3E78	00	00	00	00	30	00	00	00
3E80	14	00	00	77	30	00	77	00
3E88	00	FF	80	00	7F	80	00	FF
3E90	80	00	7F	00	30	7F	00	00
3E98	1C	00	00	03	30	00	00	00
3EA0	00	00	00	03	30	00	00	00
3EA8	00	00	00	03	30	00	00	00
3EB0	00	00	00	03	00	00	00	00
3EB8	00	00	00	03	00	00	00	00
3EC0	22	00	00	63	00	00	63	00
3EC8	00	F7	80	00	F7	80	00	FF
3ED0	80	00	7F	03	00	7F	00	00
3ED8	1C	00	00	03	00	00	00	00
3EE0	00	00	00	03	00	00	00	00
3EE8	00	AA	AA	A0	00	00	00	00
3EF0	00	00	00	00	00	00	00	00
3EF8	00	00	00	00	00	00	00	00
3F00	1C	00	00	7F	00	00	7F	00
3F08	00	FF	80	03	FF	00	00	FF
3F10	80	00	77	00	00	77	00	00
3F18	14	00	00	00	00	00	00	03
3F20	00	00	00	00	00	00	00	03
3F28	00	00	00	00	00	00	00	03
3F30	00	00	00	00	00	00	00	03
3F38	00	00	00	00	00	00	00	03
3F40	1C	00	00	7F	00	00	7F	03
3F48	00	FF	80	00	F7	80	00	F7
3F50	80	00	63	00	00	63	00	03
3F58	22	00	00	00	00	00	00	03
3F60	00	00	00	00	00	00	00	03
3F68	00	00	00	00	00	00	00	03
3F70	00	00	00	00	00	00	00	03
3F78	00	00	00	00	00	00	00	00
3F80	00	08	FF	FF	0A	AA	FF	FF
3F88	08	08	7F	7F	08	08	7F	7F
3F90	08	08	FF	FF	08	08	FF	FF
3F98	08	08	7F	7F	08	08	7F	7F
3FA0	0A	A0	FF	FF	08	08	FF	FF

3FA8	08	03	7F	7F	0E	08	7F	7F
3FB0	08	03	FF	FF	0E	08	FF	FF
3FB8	08	03	7F	7F	0E	08	7F	7F
3FC0	08	03	FF	FF	0E	08	FF	FF
3FC8	6D	08	7F	7F	0E	08	7F	7F
3FD0	08	08	FF	FF	0E	08	FF	FF
3FD8	08	08	7F	7F	0E	08	7F	7F
3FE0	08	08	FF	FF	0E	08	FF	FF
3FE8	08	08	7F	7F	08	08	7F	7F
3FF0	08	08	FF	FF	08	08	FF	FF
3FF8	08	08	7F	7F	08	08	7F	7F
4000	A0	05	B9	50	03	13	79	4A
4008	03	18	99	50	03	33	E9	0A
4010	90	0E	18	99	50	03	39	4F
4018	03	18	69	01	1A	99	4F	03
4020	88	C8	FF	D0	DD	A0	00	B9
4028	50	03	18	69	30	18	99	06
4030	04	A9	00	99	4A	03	C8	C0
4038	06	D0	EC	60	FF	FF	00	00
4040	8C	89	03	B9	5B	03	C9	00
4048	D0	0A	8D	85	03	A9	02	8D
4050	86	03	A9	00	C9	01	D0	0A
4058	A9	02	8D	86	03	A9	0D	8D
4060	85	03	C9	02	D0	0A	A9	05
4068	8D	85	03	A9	00	8D	86	03
4070	C9	03	D0	1B	C0	00	D0	0D
4078	A9	05	8D	85	03	A9	0A	8D
4080	86	03	18	90	0A	A9	05	8D
4088	85	03	A9	0B	8D	86	03	98
4090	AA	A9	01	EA	E0	00	F0	08
4098	0A	18	EA	EA	EA	CA	D0	F8
40A0	8D	88	03	AD	10	D0	2D	88
40A8	03	18	C9	00	F0	02	A9	01
40B0	8D	88	03	8C	89	03	98	0A
40B8	A8	AD	88	03	C9	00	D0	16
40C0	B9	00	D0	38	E9	1C	18	6D
40C8	85	03	18	4A	18	4A	18	4A
40D0	18	85	FB	18	90	2A	B9	00
40D8	D0	38	E9	1C	B0	0E	18	6D
40E0	85	03	90	14	18	4A	18	69
40E8	80	18	90	0D	18	6D	85	03
40F0	18	4A	18	69	00	10	90	01
40F8	4A	18	4A	18	4A	18	85	FB
4100	B9	01	D0	38	E9	33	18	6D
4108	86	03	18	4A	18	4A	18	4A
4110	10	05	FE	A9	04	85	FC	A0
4118	00	C4	FE	F0	12	A5	FB	18
4120	69	28	90	03	18	E6	FC	C8
4128	C4	FE	EA	D0	F2	85	FB	A0
4130	00	B1	FB	C9	00	F0	2E	C9
4138	28	F0	2A	C9	29	F0	26	C9
4140	2A	F0	22	C9	2B	F0	1E	C9
4148	2C	F0	1A	C9	2D	F0	16	C9
4150	2E	F0	12	C9	20	F0	0E	AC
4158	89	03	C0	30	D0	0A	A9	00
4160	60	EF	EA	EA	EA	A9	01	60
4168	C9	1E	D0	3E	B9	5B	03	C9
4170	02	F0	F2	B9	8C	03	C9	04
4178	F0	EE	A9	30	60	00	7F	7F
4180	C0	00	D0	09	E0	00	D0	01
4188	60	CA	D0	FD	60	CA	D0	FD
4190	88	D0	FA	60	00	00	FF	FF
4198	00	00	7F	7F	00	00	7F	7F
41A0	00	00	FF	FF	00	00	FF	FF
41A8	00	00	7F	7F	00	00	7F	7F
41B0	00	00	FF	FF	00	00	FF	FF
41B8	00	00	7F	7F	00	00	7F	7F
41C0	A9	39	85	FC	AD	5E	03	0A
41C8	18	0A	18	A8	EE	8F	03	4D
41D0	8A	03	C9	10	D0	05	A9	30
41D8	8D	8A	03	18	4A	16	4A	18
41E0	69	E8	90	03	18	E6	FC	85
41E8	FB	B1	FB	8D	F8	07	60	7F
41F0	00	00	FF	FF	00	00	FF	FF
41F8	00	00	7F	7F	00	00	7F	7F
4200	FF	FF	00	00	FF	FF	00	30
4208	7F	7F	00	00	7F	7F	00	30
4210	FF	FF	00	00	FF	FF	00	30
4218	7F	7F	00	00	7F	7F	00	30
4220	FF	FF	00	A0	FF	FF	AA	A0
4228	7F	7F	00	00	7F	7F	00	30
4230	FF	FF	00	00	FF	FF	00	30
4238	7F	7F	00	00	7F	7F	00	30
4240	AD	94	03	C9	01	F0	01	60
4248	A9	00	8D	94	03	A9	01	8D
4250	49	03	A9	01	85	FD	A0	00
4258	B9	20	D0	C9	F0	F0	18	A9
4260	06	99	20	D0	A9	F4	99	F9
4268	07	AD	18	D4	25	01	C9	00
4270	F0	05	A9	02	99	8D	03	06
4278	FD	18	C8	C0	04	D0	D9	A9
4280	00	8D	6D	03	8D	96	03	60
4288	7F	7F	00	00	7F	7F	00	00
4290	FF	FF	00	00	FF	FF	00	00
4298	7F	7F	00	00	7F	7F	00	00
42A0	FF	FF	00	00	FF	FF	00	00
42A8	7F	7F	00	00	7F	7F	00	00
42B0	FF	FF	00	00	FF	FF	00	00
42B8	7F	7F	00	00	7F	7F	00	00
42C0	EE	6E	03	AD	6E	03	29	01
42C8	8D	6E	03	C9	00	F0	01	60
42D0	AD	49	03	C9	01	F0	01	60
42D8	EE	6D	03	AD	6D	03	C9	FF
42E0	D0	06	A9	02	8D	49	03	60
42E8	AD	6D	03	29	03	C9	03	F0
42F0	01	60	20	00	43	AD	6D	03
42F8	29	C0	C9	C0	F0	01	60	A0
4300	00	B9	28	D0	29	0F	C9	00
4308	F0	08	C9	06	F0	0A	C9	01
4310	F0	0E	C8	C0	04	D0	EA	60
4318	A9	01	99	28	D0	18	90	F2

4320	A9	06	99	28	D0	18	90	EA
4328	00	00	7F	7F	00	00	7F	7F
4330	00	00	FF	FF	00	00	FF	FF
4338	00	00	7F	7F	00	00	7F	7F
4340	AD	49	03	C9	02	F0	01	60
4348	A9	00	8D	03	D4	A0	00	B9
4350	F9	07	C9	F4	D0	12	A9	F3
4358	99	F9	07	98	18	69	02	13
4360	99	28	D0	A9	01	99	8D	03
4368	C8	C0	04	D0	E2	A9	00	8D
4370	6D	03	8D	49	03	8D	96	03
4378	60	00	7F	7F	00	00	7F	7F
4380	A9	00	8D	03	D4	A9	14	8D
4388	0C	D4	A9	11	8D	0D	D4	A9
4390	00	8D	07	D4	AD	6D	03	C9
4398	FB	D0	0B	A9	2D	8D	08	D4
43A0	F9	11	8D	0B	D4	60	4A	18
43A8	4A	18	4A	18	69	2D	18	8D
43B0	08	D4	A9	11	8D	0B	D4	60
43B8	00	00	7F	7F	00	00	7F	7F
43C0	F9	00	8D	04	D4	A9	11	8D
43C8	04	D4	A9	09	8D	05	D4	A9
43D0	E1	8D	06	D4	A9	0F	8D	18
43D8	D4	A9	00	8D	C8	03	A2	00
43E0	F0	13	20	80	41	AD	C8	03
43E8	4A	18	8D	C9	03	A9	00	8D
43F0	00	D4	A9	1D	38	ED	C9	03
43F8	18	8D	01	D4	EE	C8	03	18
4400	C9	08	D0	DA	A9	00	8D	04
4408	D4	60	00	00	7F	7F	00	00
4410	FF	FF	00	00	FF	FF	00	00
4418	7F	7F	00	00	7F	7F	00	00
4420	FF	FF	00	00	FF	FF	00	00
4428	7F	7F	00	00	7F	7F	00	00
4430	FF	FF	00	00	FF	FF	00	00
4438	7F	7F	00	00	7F	7F	00	00
4440	A9	00	8D	04	D4	A9	11	8D
4448	04	D4	A9	09	8D	05	D4	A9
4450	01	8D	06	D4	F9	0F	8D	18
4458	D4	A9	00	8D	C8	03	A2	00
4460	A0	13	20	80	41	AD	C8	03
4468	4A	18	8D	C9	03	A9	00	8D
4470	00	D4	A9	18	38	ED	C9	03
4478	18	8D	01	D4	EE	C8	03	18
4480	C9	30	D0	DA	F9	00	8D	04
4488	D4	60	00	00	FF	FF	00	00
4490	FF	FF	00	00	FF	FF	00	00
4498	FF	FF	00	00	FF	FF	00	00
44A0	FF	FF	00	00	FF	FF	00	00
44A8	FF	FF	00	00	FF	FF	00	00
44B0	FF	FF	00	00	FF	FF	00	00
44B8	FF	FF	00	00	FF	FF	00	00
44C0	A9	30	AD	03	D4	A9	39	8D
44C8	02	D4	A9	0F	8D	18	D4	A9
44D0	00	8D	04	D4	A9	24	8D	05
44D8	D4	A9	00	8D	06	D4	A9	F5
44E0	8D	20	D4	A5	03	8D	01	D4
44E8	A9	41	8D	04	D4	60	00	00
44F0	FF	FF	00	00	FF	FF	00	00
44F8	FF	FF	00	00	FF	FF	00	00
4500	AD	05	0D	05	00	A9	02	8D
4508	85	03	A0	00	20	9F	40	A0
4510	00	31	FB	C5	00	D0	19	EE
4518	4E	03	AD	6B	03	18	69	01
4520	99	04	18	EE	6C	33	8D	6B
4528	03	A9	20	91	FB	4C	C0	44
4530	C9	28	D0	08	A9	31	8D	94
4538	03	18	90	DB	C9	29	D0	06
4540	EE	4D	03	18	90	1E	C9	2A
4548	F0	F6	C9	2B	D0	2C	AD	4D
4550	03	18	69	05	19	8D	4D	03
4558	38	E9	0A	90	07	18	8D	4D
4560	03	EE	4C	03	AD	32	03	85
4568	F3	AD	93	03	85	FC	A0	00
4570	A9	20	91	FB	C9	91	FB	4C
4578	4A	44	C9	2C	F0	D0	C9	2E
4580	F0	05	C9	2E	F0	01	60	EE
4588	4C	03	18	90	D7	00	7F	7F
4590	00	00	FF	FF	00	00	FF	FF
4598	00	00	7F	7F	00	00	7F	7F
45A0	00	00	FF	FF	00	00	FF	FF
45A8	00	00	7F	7F	00	00	7F	7F
45B0	00	00	FF	FF	00	00	FF	FF
45B8	00	00	7F	7F	00	00	7F	7F
45C0	A5	C5	C9	0C	D0	03	A9	00
45C8	60	C9	17	D0	03	A9	01	60
45D0	C9	06	D0	03	A9	02	60	C9
45D8	03	D0	03	A9	03	60	A9	FF
45E0	60	00	FF	FF	00	00	FF	FF
45E8	00	00	7F	7F	00	00	7F	7F
45F0	00	00	FF	FF	00	00	FF	FF
45F8	00	00	7F	7F	00	00	7F	7F
4600	AD	01	DC	29	04	C9	00	D0
4608	03	A9	00	60	AD	01	DC	29
4610	08	C9	00	D0	03	A9	01	60
4618	AD	01	DC	29	01	C9	00	D0
4620	03	A9	02	60	AD	01	DC	29
4628	02	C9	00	D0	03	A9	03	60
4630	A9	FF	60	00	FF	FF	00	00
4638	FF	FF	00	00	FF	FF	00	00
4640	AD	91	03	C9	00	D0	06	20
4648	C0	45	18	90	03	20	00	46
4650	C9	FF	D0	01	60	AC	5D	03
4658	8C	87	03	8D	5B	03	A0	00
4660	20	40	40	C9	01	F0	06	AD
4668	87	03	8D	5B	03	60	00	00
4670	FF	FF	00	00	FF	FF	00	00
4678	FF	FF	00	00	FF	FF	00	00
4680	84	FD	A0	B9	00	D0	18	69

(Hex dump continued on page 114)



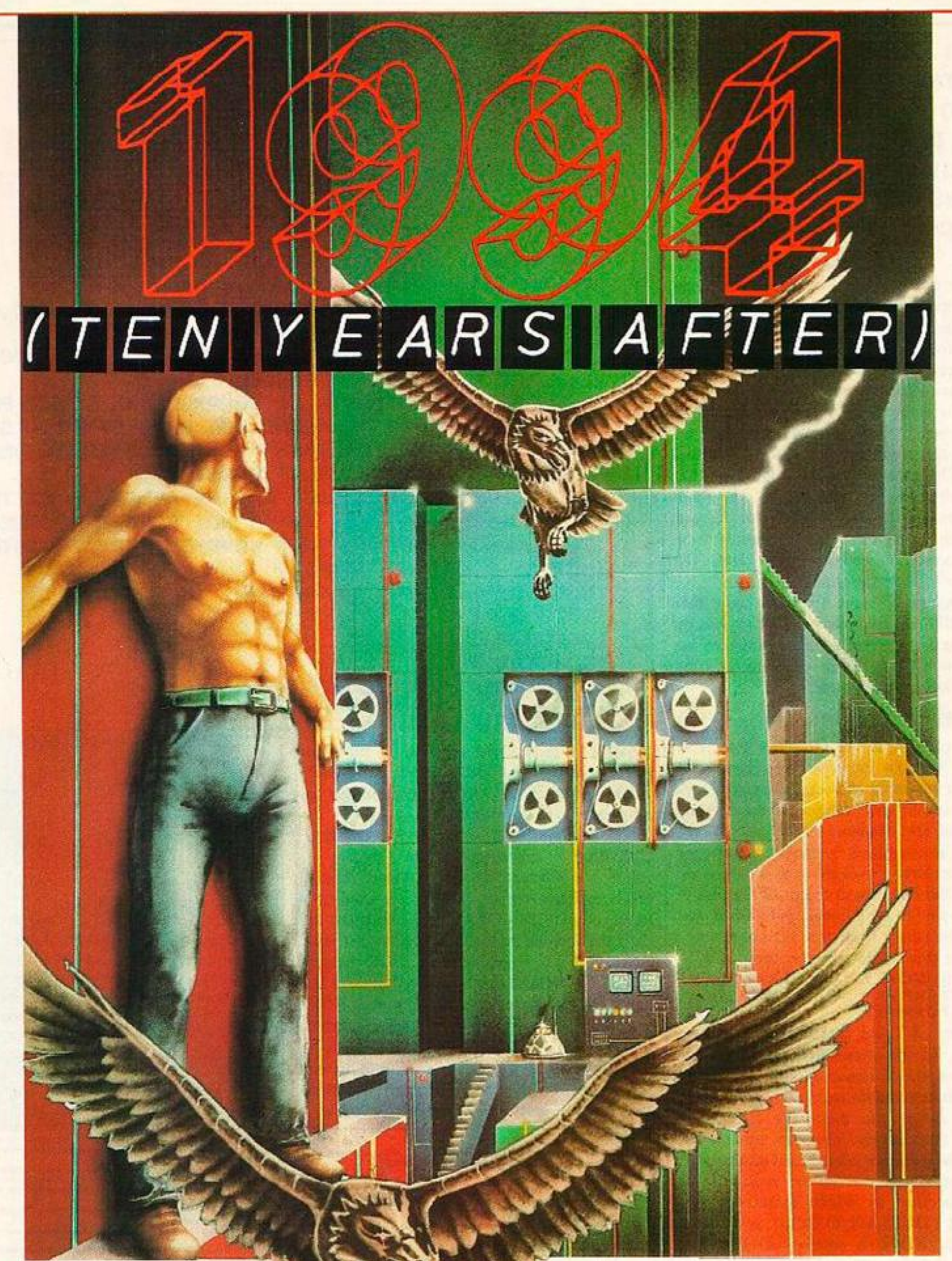
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(Hex dump continued from page 112)

4688	01	36	E9	18	18	05	FE	10
4690	4A	18	4A	18	4A	18	0A	18
4698	0A	18	0A	18	C5	FE	F0	01
46A0	60	A4	FD	B9	01	D0	18	69
46A8	01	38	E9	32	18	85	FE	18
46B0	4A	18	4A	18	4A	18	0A	18
46B8	0A	18	0A	18	C5	FE	F0	01
46C0	60	A4	FD	C0	00	F2	0C	4E
46C8	97	03	20	40	46	8D	97	03
46D0	18	90	03	20	40	46	A4	FD
46D8	B9	5B	03	C9	04	D0	01	50
46E0	20	40	43	C9	01	D0	01	50
46E8	A4	FD	A9	04	99	5B	03	50
46F0	FF	FF	00	00	FF	FF	00	00
46F8	FF	FF	80	80	FF	FF	80	80
4700	00	00	FF	FF	00	00	FF	FF
4708	80	80	7F	7F	80	80	7F	7F
4710	00	00	FF	FF	00	00	FF	FF
4718	00	00	7F	7F	00	00	7F	7F
4720	00	00	FF	FF	00	00	FF	FF
4728	00	00	7F	7F	00	00	7F	7F
4730	00	00	FF	FF	00	00	FF	FF
4738	00	00	7F	7F	00	00	7F	7F
4740	C9	04	D0	01	60	C9	03	D0
4748	4E	BD	00	D0	38	E5	01	80
4750	10	9D	00	D0	AD	10	D0	38
4758	E5	FD	18	8D	10	D0	18	90
4760	04	18	9D	00	D0	BD	00	30
4768	C9	17	D0	18	AD	10	D0	25
4770	FD	C9	00	D0	0F	A9	4A	9D
4778	00	D0	AD	10	D0	18	65	FD
4780	18	8D	10	D0	C0	00	D0	01
4788	60	B9	F8	07	C9	F4	D0	01
4790	60	A9	F0	99	F8	07	60	C9
4798	01	D0	4E	BD	00	D0	18	69
47A0	01	90	11	18	9D	00	D0	AD
47A8	10	D0	18	65	FD	18	8D	10
47B0	D0	18	90	03	9D	00	D0	BD
47B8	00	D0	C9	4B	D0	18	AD	10
47C0	D0	25	FD	C9	00	F0	0F	A9
47C8	18	9D	00	D0	AD	10	D0	38
47D0	E5	FD	18	8D	10	D0	C0	00
47D8	D0	01	60	B9	F0	07	C9	F4
47E0	D0	01	60	F9	F1	99	F8	07
47E8	50	C9	02	D0	1D	BD	01	D0
47F0	38	E9	01	18	9D	01	D0	C0
47F8	00	D0	01	60	B9	F8	07	C9
4800	F4	D0	01	60	A9	F2	99	F8
4808	07	60	BD	01	D0	18	69	01
4810	18	9D	01	D0	C0	00	D0	01
4818	60	B9	F8	07	C9	F4	D0	01
4820	60	A9	F3	99	F8	07	60	00
4828	FF	FF	80	80	FF	FF	80	80
4830	FF	FF	00	00	FF	FF	00	00
4838	FF	FF	80	80	FF	FF	80	80
4840	A9	01	85	FD	A0	00	A2	00
4848	B9	5B	03	20	40	47	C8	E8
4850	E0	04	F0	18	AD	6D	03	29
4858	01	C9	01	F0	04	C0	05	D0
4860	E7	60	00	00	FF	FF	00	00
4868	FF	FF	80	80	FF	FF	80	E0
4870	FF	FF	00	00	FF	FF	00	E0
4878	FF	FF	80	80	FF	FF	80	E0
4880	AD	1B	D4	8D	95	03	AC	F4
4888	03	AE	A3	03	20	84	41	FD
4890	1D	D4	8D	A6	03	29	C0	C9
4898	00	F0	01	60	AD	F5	03	C9
48A0	39	F0	01	60	AD	92	03	E5
48A8	FB	AD	93	03	35	FC	AD	F6
48B0	03	29	06	C9	06	D0	02	A9
48B8	00	18	69	29	18	A0	00	91
48C0	FB	18	69	01	18	C8	91	FB
48C8	AA	A5	FC	18	69	D4	18	85
48D0	FC	8A	A0	00	C9	2A	D0	08
48D8	A9	02	91	FB	C8	91	FB	60
48E0	C9	2C	F0	F4	A9	08	18	90
48E8	EF	7F	00	00	7F	7F	00	00
48F0	FF	FF	00	00	FF	FF	00	00
48F8	7F	7F	00	00	7F	7F	00	00
4900	AD	10	D0	25	FD	C9	00	F0
4908	03	A9	AA	60	B9	02	D0	38
4910	ED	A1	03	B0	03	A9	00	60
4918	18	B9	02	D0	38	ED	A2	03
4920	90	04	18	A9	00	60	B9	03
4928	D0	38	ED	9F	03	D0	03	A9
4930	00	60	18	B9	03	D0	38	ED
4938	A0	03	90	04	18	A9	00	60
4940	A9	01	60	FF	00	00	FF	FF
4948	A5	80	FF	FF	80	80	FF	FF
4950	00	00	FF	FF	00	00	FF	FF
4958	80	80	FF	FF	80	80	FF	FF
4960	00	00	FF	FF	00	00	FF	FF
4968	E0	80	FF	FF	80	80	FF	FF
4970	C0	00	FF	FF	00	00	FF	FF
4978	E0	80	FF	FF	80	80	FF	FF
4980	ED	1E	C0	18	29	01	18	C9
4988	00	D0	01	60	A0	00	A9	02
4990	E5	FD	AD	1E	C0	25	FD	C9
4998	00	F0	0E	20	40	50	C9	00
49A0	F0	07	B9	8D	03	C9	03	D0
49A8	0B	06	FD	C8	C0	04	D0	E2
49B0	60	B9	F9	07	C9	F4	F0	06
49B8	A9	01	8D	95	03	60	A9	03
49C0	99	8D	03	A9	00	99	20	D0
49C8	A9	F0	99	F9	07	EE	96	03
49D0	AD	96	03	C9	01	D0	19	A9
49D8	02	18	6D	4D	03	18	8D	4D
49E0	03	38	E9	0A	90	07	18	8D

49E8	4D	03	EE	4C	03	4C	C0	43
49F0	C9	02	D0	05	A9	04	18	90
49F8	E0	C9	03	D0	05	A9	08	18
4A00	90	D7	EE	4C	03	A9	06	18
4A08	90	CF	80	80	FF	FF	80	80
4A10	FF	FF	00	00	FF	FF	00	00
4A18	FF	FF	80	80	FF	FF	80	80
4A20	FF	FF	00	00	FF	FF	00	00
4A28	FF	FF	80	80	FF	FF	80	80
4A30	FF	FF	00	00	FF	FF	00	00
4A38	FF	FF	80	80	FF	FF	80	80
4A40	A0	00	84	FF	B9	A9	03	A4
4A48	02	99	5C	03	C8	20	40	40
4A50	C9	01	F0	0F	A4	FF	C8	C0
4A58	0A	D0	E7	AD	A0	03	A4	02
4A60	99	5C	03	60	FF	FF	00	00
4A68	FF	FF	80	80	FF	FF	80	80
4A70	FF	FF	00	00	FF	FF	00	00
4A78	FF	FF	80	80	FF	FF	80	80
4A80	20	40	3A	A4	02	B9	5C	03
4A88	8D	AA	03	AD	A8	03	8D	AD
4A90	03	4C	40	4A	FF	FF	00	00
4A98	FF	FF	80	80	FF	FF	80	80
4AA0	FF	FF	00	00	FF	FF	00	00
4AA8	FF	FF	80	80	FF	FF	80	80
4AB0	FF	FF	00	00	FF	FF	00	00
4AB8	FF	FF	80	80	FF	FF	80	80
4AC0	A5	03	8D	A9	03	8D	AA	03
4AC8	4C	40	4A	80	FF	FF	80	80
4AD0	FF	FF	00	00	FF	FF	00	00
4AD8	FF	FF	80	80	FF	FF	80	80
4AE0	FF	FF	00	00	FF	FF	00	00
4AE8	FF	FF	80	80	FF	FF	80	80
4AF0	FF	FF	00	00	FF	FF	00	00
4AF8	FF	FF	80	80	FF	FF	80	80
4B00	20	D0	3A	C9	FF	D0	03	4C
4B08	40	4A	8D	AA	03	49	01	18
4B10	8D	AC	03	A4	02	B9	5C	03
4B18	8D	AB	03	4C	40	4A	7F	7F
4B20	00	00	FF	FF	00	00	FF	FF
4B28	00	00	7F	7F	00	00	7F	7F
4B30	00	00	FF	FF	00	00	FF	FF
4B38	00	00	7F	7F	00	00	7F	7F
4B40	AD	1B	D4	29	03	8D	A9	03
4B48	49	01	18	8D	AB	03	A4	02
4B50	B9	5C	03	8D	AA	03	AD	A8
4B58	03	8D	AC	03	4C	40	4A	7F
4B60	00	00	FF	FF	00	00	FF	FF
4B68	00	00	7F	7F	00	00	7F	7F
4B70	00	00	FF	FF	00	00	FF	FF
4B78	00	00	7F	7F	00	00	7F	7F
4B80	A9	02	8D	A9	03	A4	02	B9
4B88	5C	03	29	01	8D	AA	03	49
4B90	01	18	8D	AB	03	4C	40	4A
4B98	00	00	7F	7F	00	00	7F	7F
4BA0	00	00	FF	FF	00	00	FF	FF
4BA8	00	00	7F	7F	00	00	7F	7F
4BB0	00	00	FF	FF	00	00	FF	FF
4BB8	00	00	7F	7F	00	00	7F	7F
4BC0	B9	02	D0	38	E9	AF	90	21
4BC8	18	8D	98	03	AD	13	D0	25
4BD0	FD	C9	00	D0	09	8D	99	03
4BD8	A9	00	8D	9A	03	60	A9	01
4BE0	8D	99	03	A9	00	8D	9A	03
4BE8	60	A9	AF	38	F9	02	D0	18
4BF0	8D	98	03	AD	10	D0	25	FD
4BF8	C9	00	D0	09	8D	99	03	A9
4C00	01	8D	9A	03	60	A9	00	8D
4C08	99	03	38	ED	98	03	18	8D
4C10	98	03	A9	00	8D	9A	03	60
4C18	FF	FF	80	80	FF	FF	80	80
4C20	FF	FF	00	00	FF	FF	00	00
4C28	FF	FF	80	80	FF	FF	80	80
4C30	FF	FF	00	00	FF	FF	00	00
4C38	FF	FF	80	80	FF	FF	80	80
4C40	20	CA	4A	B9	03	D0	38	ED
4C48	9E	03	90	0C	18	8D	9B	03
4C50	A9	00	8D	9C	03	18	90	10
4C58	AD	9E	03	38	F9	03	D0	18
4C60	8D	9B	03	A9	01	8D	9C	03
4C68	AD	98	03	38	ED	9B	03	B0
4C70	0F	AD	99	03	C9	00	D0	08
4C78	AD	9C	03	18	69	02	18	60
4C80	10	AD	9A	03	60	FF	00	00
4C88	FF	FF	80	80	FF	FF	80	80
4C90	FF	FF	00	00	FF	FF	00	00
4C98	FF	FF	80	80	FF	FF	80	80
4CA0	FF	FF	00	00	FF	FF	00	00
4CA8	FF	FF	80	80	FF	FF	80	80
4CB0	FF	FF	00	00	FF	FF	00	00
4CB8	FF	FF	80	80	FF	FF	80	80
4CC0	B9	02	D0	38	ED	00	D0	90
4CC8	4A	18	ED	98	03	AD	10	D0
4CD0	25	FD	C9	00	D0	06	8D	99
4CD8	03	18	90	05	A9	01	8D	99
4CE0	03	AD	10	D0	29	01	38	ED
4CE8	99	03	50	21	18	C9	01	F0
4CF0	09	8D	99	03	A9	00	8D	9A
4CF8	03	60	A9	01	8D	9A	03	A9
4D00	00	8D	99	03	38	ED	98	03
4D08	18	8D	98	03	60	A9	00	8D
4D10	9A	03	60	AD	00	D0	38	F9
4D18	02	D0	10	8D	98	03	AD	10
4D20	D0	25	FD	C9	00	D0	06	8D
4D28	99	03	18	90	05	A9	01	8D
4D30	99	03	AD	10	D0	29	01	38
4D38	ED	99	03	90	18	18	C9	01
4D40	F0	0E	A9	01	8D	9A	03	A9
4D48	00	8D	99	03	60	A9	00	8D
4D50	9A	03	A9	01	8D	99	03	60
4D58	A9	00	38	ED	98	03	18	8D

4D60	98	03	A9	00	8D	99	03	8D
4D68	9A	03	60	7F	00	00	7F	7F
4D70	00	00	FF	FF	00	00	FF	FF
4D78	00	00	7F	7F	00	00	7F	7F
4D80	20	C0	4C	B9	03	D0	38	ED
4D88	01	D0	90	0C	18	8D	9B	03
4D90	A9	00	8D	9C	03	18	90	10
4D98	AD	01	D0	38	F9	03	D0	18
4DA0	8D	9B	03	A9	01	8D	9C	03
4DA8	E0	01	D0	10	AD	9C	03	49
4DB0	01	8D	9C	03	AD	9A	03	49
4DB8	01	8D	9F	03	AD	98	03	38
4DC0	ED	9B	03	B0	13	AD	99	03
4DC8	C9	00	D0	0C	30	01	F0	0C
4DD0	AD	9C	03	18	69	02	18	60
4DD8	E0	01	F0	F4	AD	9A	03	60
4DE0	00	00	FF	FF	00	00	FF	FF
4DE8	00	00	7F	7F	00	00	7F	7F
4DF0	00	00	FF	FF	00	00	FF	FF
4DF8	00	00	7F	7F	00	00	7F	7F
4E00	98	0A	A8	20	00	49	A4	02
4E08	C9	01	F0	03	4C	CB	4E	A9
4E10	05	99	8D	03	4C	58	4F	00
4E18	FF	FF	80	80	FF	FF	80	80
4E20	FF	FF	00	00	FF	FF	00	00
4E28	FF	FF	80	80	FF	FF	80	80
4E30	FF	FF	00	00	FF	FF	00	00
4E38	FF	FF	80	80	FF	FF	80	80
4E40	AD	98	03	C9	00	F0	03	4C
4E48	CB	4E	AD	99	03	C9	00	D0
4E50	F6	AD	9B	03	C9	00	D0	EF
4E58	A4	02	A9	04	99	8D	03	4C
4E60	44	4F	00	00	FF	FF	00	00
4E68	FF	FF	80	80	FF	FF	80	80
4E70	FF	FF	00	00	FF	FF	00	00
4E78	FF	FF	80	80	FF	FF	80	80
4E80	A0	00	A2	20	20	80	41	AD
4E88	1B	D4	29	03	C9	00	D0	09
4E90	A9	01	A4	02	99	8D	03	60
4E98	C9	01	F0	F4	C9	02	D0	09
4EA0	A9	00	A4	02	99	8D	03	60
4EA8	A9	02	A4	02	99	8D	03	60
4EB0	FF	FF	00	00	FF	FF	00	00
4EB8	FF	FF	80	80	FF	FF	80	80
4EC0	A0	00	84	02	A9	02	85	FD
4EC8	18	90	0D	A4	02	C8	84	02
4ED0	C0	04	D0	01	60	06	FD	18
4ED8	FD	10	D0	25	FD	18	8D	08
4EE0	A3	9A	0A	A8	B9	02	D0	18
4EE8	69	01	38	E9	18	18	85	FE
4EF0	18	4A	18	4A	18	4A	18	0A
4EF8	18	0A	18	0A	18	C5	FE	D0
4F00	CA	B9	03	D0	A4	02	18	69
4F08	01	38	E9	32	18	85	FE	13
4F10	4A	18	4A	18	4A	18	0A	13
4F18	0A	18	0A	18	C5	FE	D0	A8
4F20	B9	5C	03	49	01	0D	A0	03
4F28	B9	8D	03	C9	03	D0	11	98
4F30	0A	A8	18	20	40	4C	A4	02
4F38	20	80	4A	A4	02	4C	40	4E
4F40	C9	04	D0	08	20	C0	4A	A4
4F48	02	4C	00	4E	98	0A	A8	20
4F50	00	49	A4	02	C9	01	D0	15
4F58	B9	28	D0	C9	F0	D0	08	98
4F60	18	69	02	18	99	28	D0	20
4F68	60	4B	4C	CB	4E	AD	1B	D4
4F70	29	FE	18	C9	FC	D0	03	20
4F78	60	4E	B9	8D	03	C9	00	D0
4F80	06	20	40	4B	4C	CB	4E	C9
4F88	01	D0	10	A2	00	98	0A	A8
4F90	20	80	4D	A4	02	20	80	4A
4F98	18	9A	AD	A2	01	98	0A	A8
4FA0	20	80	4D	A4	02	20	80	43
4FA8	4C	CB	4E	7F	00	00	7F	7F
4FB0	00	00	FF	FF	00	00	FF	FF
4FB8	00	00	7F	7F	00	00	7F	7F
4FC0	20	30	40	20	C0	41	20	40
4FC8	43	20	C0	42	20	40	42	20
4FD0	80	48	20	00	45	A9	00	A0
4FD8	00	20	60	46	20	40	48	AD
4FE0	1E	D0	20	80	49	AD	95	03
4FE8	C9	01	D0	03	A9	FF	60	AD
4FF0	8B	03	CD	6E	03	D0	0B	AD
4FF8	8C	03	CD	6C	03	D0	03	A9
5000	03	60	A5	C5	C9	3F	D0	01
5008	60	AC	A4	03	AE	A3	03	20
5010	80	41	20	C0	4E	18	90	A8
5018	7F	7F	00	00	7F	7F	00	00
5020	FF	FF	00	00	FF	FF	00	00
5028	7F	7F	00	00	7F	7F	00	00
5030	FF	FF	00	00	FF	FF	00	00
5038	7F	7F	00	00	7F	7F	00	00
5040	AD	10	D0	25	FD	C9	00	F0
5048	02	A9	01	8D	B4	03	98	0F
5050	A8	B9	03	D0	38	ED	01	D0
5058	B0	07	AD	01	D0	38	F9	03
5060	D0	38	E9	0B	90	08	18	98
5068	4A	18	A8	A9	00	60	B9	02
5070	D0	38	ED	00	D0	30	0C	AD
5078	00	D0	38	F9	02	D0	18	A2
5080	01	90	02	A2	00	8D	B5	03
5088	38	E9	0F	90	35	AD	10	D0
5090	29	01	CD	B4	03	F0	25	EE
5098	01	F0	0E	C9	01	D0	1D	AD
50A0	B4	03	C9	00	D0	16	18	90
50A8	0B	C9	00	D0	0F	AD	B4	03
50B0	C9	01	D0	08	AD	35	03	18
50B8	69	F1	90	11	98	4A	18	A8
50C0	A9	00	60	AD	10	D0	29	01
50C8	CD	B4	03	D0	EF	98	4A	18
50D0	A8	A9	01	60	FF	FF	00	00



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SQUARES

Keith Miles with a Basic program for the BBC Micro that makes use of EOR printing and multi-colour characters. This makes Squares shorter to type in and faster to play.

SQUARES IS A variation on an arcade game written by several software houses.

The aim of Squares is to guide your boot around the grid, colouring each line and square traversed. The values shown in the squares are added to your score as they are made. To make it interesting a monster is pursuing you. This creature will erase all lines you have coloured that do not form a part of a square. There are also immobile monsters that periodically jump to new locations which you should be careful not to run into. As you proceed to higher levels the number of these latter monsters increases as does the frequency of their movements.

The particular features of this game that make it different from most games previously written in Basic is that it makes extensive use of Exclusive Or — EOR — colour printing and multicolour characters.

Shorter and faster

When printing at the Graphics Cursor — VDU 5 — it is possible to superimpose defined or any other charactgers on top of each other. Using different colours for the different features of the character to be created, the character is assembled by moving the cursor to the required location and successively selecting the foreground colour of the part of the character to be printed, printing it and moving the cursor back over the character.

In Basic this would take the form:

```
VDU5 : MOVE X,Y : GCOL3,Y1 :
PRINT CHR$(X1) : VDU8 : GCOL3,Y2 :
PRINT CHR$(X2)
```

etc., where X,Y are the desired screen co-ordinates, Y1 the colour of character X1 and Y2 the colour of character X2. The VDU commands cause printing to take place at the graphics cursor and move the cursor one space left respectively. The man, squares and walls in the game are constructed on this way. These commands can all be replaced and strung together as VDU commands eg., MOVE is VDU25,4,X;Y; GCOL is VDU18, 3,Y1 and PRINT is simply VDUX2. For example, the above line of Basic would now read:

```
VDU5,25,4,X;Y;18,3,Y1,X1,8,18,3,Y2,X2
```

Not only is this shorter but it executes faster. This is very important for the more complicated a character is the longer it takes to print and the slower movement will be.

EOR printing is important when coloured characters are to be moved. Refer to the User Guide for a detailed explanation, but when printing graphics characters colour is chosen with GCol x,y where function x determines how colour y will be printed. x can have five values 0,1,2,3,4 which respectively print the colour, Or it with the colour already there, And it the colour already there, EOR it etc and Invert it etc. EOR (3) is used because it is possible to predict the outcome of function and by careful manipulation of the colour palette using VDU 19 to enable characters to move over other characters.

For example, Red — colour 1 — EORed with Blue — colour 4 — gives Magenta — colour 5 — if a red character is printed on top of a blue character, but if colour 5 is redefined to be red — VDU19,5,1,0,0,0 — that part of the red character over the blue character will show red not magenta. The EOR values needed are mathematically derived but can be easily found by using the BBC's own EOR function — type 1 EOR 4 to check the above example.

The game itself consists of a series of linked procedures which are called from within a Repeat Until loop which controls the game.

Program 1

```
10MODE2
20VDU23,1,0;0;0;0;
30VDU23,224,31,23,31,23,127,255,0,0,23,225,0,0,0,0,
0,0,255,215:REM Boot, sole
40VDU23,226,126,255,153,153,255,255,255,170,23,227,
0,0,68,102,0,0,0,0:REM Monster ,eyes
50COLOUR1:PRINTTAB(6,1)"SQUARES.":COLOUR2:PRINT''"
 GUIDE YOUR BOOT"'" AROUND THE GRID OF"'"   SQUARES S
CORING"'"  POINTS FOR EACH"'"  COMPLETED SQUARE,"'" WH
ILE AVOIDING THE"'"    BLUE MONSTERS."
60COLOUR4:PRINT'"LINES CAN BE REMOVED  BY THE PURSU
ING"'" MONSTER IF THEY DO"'" NOT FORM A SQUARE."
70COLOUR3:PRINT'"  YOUR MOVEMENT IS"'" CONTROLLED B
Y THE"'"    CURSOR KEYS."
80COLOUR1:PRINT'"  <RETURN> TO PLAY"'
90COLOUR1
100VDU28,3,31,17,23
110*FX21,0
120IFINKEY(-74) MODE7:CHAIN"Square2"
130GOTO110
```

Variables.

lvl% — level.bootx% and monsterx% — horizontal position, booty% and monstery% — vertical position,right% and HORZ% — 0 or 1 moving right or left, Down% and VERT% — 0 or 1 moving up or down,colour% and COLOR% — colour of line traversed,col% and COL% — colour of line coloured,(oldx%,oldy%,OLDX%, OLDY%) — starting coordinates of move, (hor%, ver%,HOR%,VER%) — destination coordinates of move,linedown% and lineacross% positions on the grid stored as a decimal eg., 27=intersection 2 across and 7 up,across% and down% — old horizontal and vertical location of monster,fill% — flag for number of squares filled,hit% — flag for identifying game over.

Program 2.

```
1*KEY0 *TAPE:MDELETE1,3:MF0RI%=0 TO TOP-PAGE STEP4
:I%!&E00=I%!&1900:NEXT:MPAGE=&1900:MEND:MRUN:M
2*FX138,0,128
3END
4REM Delete lines 1 to 5 if Disc Interface not fitted
10DIMSC%(7),Y%(10),sc%(6,9),lineacross%(6,10),linedo
wn%(7,9),X%(9),M%(9)
20ONERROR VDU4,30:REPORT:PRINTERL:END
30HI%=0
40MODE2
50PROCcolour
60PROCnewgame
70PROCinit
80PROCgrid
90IFlvl%>9 lvl%=9
100PROCboot(bootx%,booty%)
110PROCmonster(monsterx%,monstery%)
120PROCstill monster
130REPEAT
140IFINKEY(-26)ANDbootx%>32ANDbooty%MOD96=16 bootx%=
bootx%-64:right%=1:colour%=FNpt(bootx%+20,booty%-16):P
ROCboot(bootx%+64,booty%):PROCboot(bootx%,booty%):GOTO
180
150IFINKEY(-122)ANDbootx%<1184ANDbooty%MOD96=16 boot
x%=bootx%+64:right%=0:colour%=FNpt(bootx%-20,booty%-16
):PROCboot(bootx%-64,booty%):PROCboot(bootx%,booty%):G
OTO180
160IFINKEY(-58)ANDbooty%<976ANDbootx%MOD96=32 booty%
=booty%+32:Down%=0:colour%=FNpt(bootx%,booty%-20):PROC
boot(bootx%,booty%-32):PROCboot(bootx%,booty%):GOTO190
170IFINKEY(-42)ANDbooty%>112ANDbootx%MOD96=32 booty%
=booty%-32:Down%=1:colour%=FNpt(bootx%,booty%+20):PROC
boot(bootx%,booty%+32):PROCboot(bootx%,booty%)
180IFcolour%=1 col%=3 ELSE col%=7
190IFcolour%=7 col%=6
200GCOL3,col%
210IFright%=1ANDbootx%MOD192=32 hor%=bootx%DIV192:MO
VEX%(oldx%),Y%(oldy%):DRAWX%(hor%),Y%(ver%):lineacross
%=oldx%*10+oldy%:PROClineacross(lineacross%):oldx%=hor
%:right%=-1:GOTO260
220IFright%=0ANDbootx%MOD192=32 hor%=bootx%DIV192:MO
VEX%(oldx%),Y%(oldy%):DRAWX%(hor%),Y%(ver%):lineacross
%=hor%*10+ver%:PROClineacross(lineacross%):oldx%=hor%:
right%=-1:GOTO260
230IFDown%=1ANDbooty%MOD96=16 ver%=booty%DIV96-1:MOV
EX%(oldx%),Y%(oldy%):DRAWX%(hor%),Y%(ver%):linedown%=h
or%*10+oldy%:PROClinedown(linedown%):oldy%=ver%:Down%=
-1:GOTO260
240IFDown%=0ANDbooty%MOD96=16 ver%=booty%DIV96-1:MOV
EX%(oldx%),Y%(oldy%):DRAWX%(hor%),Y%(ver%):linedown%=h
or%*10+ver%:PROClinedown(linedown%):oldy%=ver%:Down%=-
1
250IFSC%>HI% HI%=SC%:VDU4:PRINTTAB(11,31);HI%;:VDU5
260PROCmovemonster:SOUND&10,-6,1,2
270IFRND(1)>.95-(lvl%/10) PROCrandommonster:SOUND&10
,-6,2,2
280colour%=FNPT(bootx%,booty%):IFcolour%=8OR colour%
=14 PROCend:hit%=1
290UNTIL hit%=1ORfill%=54
300IFhit%=0 lvl%=lvl%+1:GOTO70
310GOTO60
320DEF PROCnewgame
330hit%=0:lvl%=1:SC%=0
340ENDPROC
350DEF PROCinit
360FORX%=64TO1216STEP192:X%(X%DIV192)=X%:NEXT
370FORY%=960TO96STEP-96:Y%(Y%DIV96-1)=Y%:NEXT
380FORX%=0TO6:FORY%=0TO10:lineacross%(X%,Y%)=0:NEXT,
390FORX%=0TO7:FORY%=0TO9:linedown%(X%,Y%)=0:NEXT,
400bootx%=32:booty%=112:monsterx%=32:monstery%=976:a
cross%=0:down%=9
410colour%=6:COLOR%=6:VERT%=9:HORZ%=0:right%=0:Down%
=0
420oldx%=0:oldy%=9:hor%=0:ver%=9
430OLDX%=0:OLDY%=9:HOR%=0:VER%=9
440ENDPROC
450DEFPROCgrid
460VDU12,4,17,1:PRINTTAB(6,0)"SQUARES"
470VDU5,18,0,6
480FORI%=960TO32STEP-96:MOVE64,I%:DRAW1216,I%:NEXT
490FORJ%=64TO1216STEP192:MOVEJ%,96:DRAWJ%,960:NEXT
500VDU4,17,1:sc%=0:fill%=0:FORI%=1TO6:K%=0:FORJ%=9T
O1STEP-1:K%=K%+2:sc%(I%,J%)=RND(9):PRINTTAB((I%*3)-1,K
%);sc%(I%,J%):NEXT,
510COLOUR7:PRINTTAB(1,30)"SCORE"TAB(1,31);SC%;:COLOU
R3:PRINTTAB(11,30)"HI-SCORE"TAB(11,31);HI%;:VDU5
520ENDPROC
530DEFPROCend
540FORI%=1TO10:SOUND&10,-12,6,10:FORJ%=1TO10:VDU19,0
,RND(6);0;:FORI=1TO5:NEXT,,
550VDU19,0,0;0;4,17,1:PRINTTAB(2,14)"<RETURN> TO PLA
Y"TAB(3,16)"<SPACE> TO END"
```

SQUARES

SCORE 0

HI-SCORE 13

Arrays.

X%(—),Y%(—)—horizontal and vertical locations of grid intersections on Graphics grid.

sc%(X,Y)—sqaure scores.

lineacross%(X,Y)—status of horizontal lines (0 not traversed or wiped by monster, 1 traversed, 2 secure in a square).

linedown%(X,Y)—status of vertical lines.

MX(—),MY(—)—horizontal and vertical locations of still monsters.



```
560NEXT21,0
570IFINKEY(-74) ENDPROC
580IFINKEY(-99) VDU22,7:END
590GOTO560
600DEFPROCmovemonster
610across%=monsterx%
620down%=monstery%
630IFmonsterx%=bootx%THEN650 ELSE VERT%=-16:IFbootx%
<monsterx% level%=-31:HORI%=20:ELSE level%=31:HORI%=-2
0
640monsterx%=monsterx%+(monsterx%>bootx%)-(monsterx
%<bootx%)+level%:IFmonsteryMOD96<>6THENmonsterx%=ac
ross%
650IFmonstery%=booty%THEN670 ELSE HORI%=0:IFbooty%<m
onsterx%THENup%=-15:VERT%=0 ELSE up%=15:VERT%=-20
660monstery%=monstery%+(monstery%>booty%)-(monstery
%<booty%)+up%:IFmonsterx%MOD192<>32THENmonstery%=dow
n%
670COLOR%=FNpt(monsterx%+HORI%,monstery%+VERT%)
680IFCOLOR%=10ORCOLOR%=9 COL%=7 ELSE COL%=0
690PROCmonster(across%,down%)
700PROCmonster(monsterx%,monstery%)
710GCOL3,COL%
720IFmonsterx%MOD192=32 HORI%=monsterx%DIV192:PROCunc
olk:OLDX%=HORI%
730IFmonstery%MOD96=16 VERT%=monstery%DIV96 1:PROCunc
olk:OLDY%=VERT%
740ENDPROC
750DEFPROCmonster(X%,Y%)
760VDU25,4,X%;Y%;18,3,8,226,8,10,3,7,227
770ENDPROC
780DEFPROCboot(x%,y%)
790VDU25,4,x%;y%;18,3,9,224,8,10,3,3,225
800ENDPROC
810DEFPROClineacross(X%)
820A1%=X%DIV10:B1%=X%MOD10
830IFlineacross%(A1%,B1%)=0 lineacross%(A1%,B1%)=1
840PROCsquare_(A1%,B1%)
850ENDPROC
860DEFPROClinedown(a%)
870A2%=a%DIV10:B2%=a%MOD10
880IFlinedown%(A2%,B2%)=0 linedown%(A2%,B2%)=1
890PROCsquareup(A2%,B2%)
900ENDPROC
910DEFPROCsquare_(a1%,b1%)
920IFa1%=0ORb1%=0THEN940
930IFlineacross%(a1%,b1%-1)<>0AND linedown%(a1%-1,b1
%)<>0AND linedown%(a1%,b1%)<>0AND sc%(a1%,b1%)<>0 PROC
drawsquare(a1%-1,b1%-1):PROCscoredacross(a1%,b1%)
940IFa1%=0ORb1%=9THEN960
950IFlineacross%(a1%,b1%+1)<>0AND linedown%(a1%-1,b1
%+1)<>0AND linedown%(a1%,b1%+1)<>0AND sc%(a1%,b1%+1)<>
0 PROCdrawsquare(a1%-1,b1%):PROCscoredacross(a1%,b1%+1
)
960ENDPROC
970DEFPROCsquareup(a2%,b2%)
980IFa2%=0ORb2%=0THEN1000
990IFlinedown%(a2%-1,b2%)<>0AND lineacross%(a2%,b2%)
<>0AND lineacross%(a2%,b2%-1)<>0AND sc%(a2%,b2%)<>0 PR
OCdrawsquare(a2%-1,b2%-1):PROCscoredup(a2%,b2%)
1000IFa2%=6ORb2%=0THEN1020
1010IFlinedown%(a2%+1,b2%)<>0AND lineacross%(a2%+1,b2
%)<>0AND lineacross%(a2%+1,b2%-1)<>0AND sc%(a2%+1,b2%)
<>0 PROCdrawsquare(a2%,b2%-1):PROCscoredup(a2%+1,b2%)
1020ENDPROC
1030DEFPROCdrawsquare(z1%,z2%)
1040VDU29,18,3,6
1050MOVEX%(z1%),Y%(z2%):MOVEX%(z1%+1),Y%(z2%)
1060PLOT85,X%(z1%),Y%(z2%+1)
1070MOVEX%(z1%+1),Y%(z2%+1)
1080PLOT85,X%(z1%+1),Y%(z2%)
1090ENDPROC
1100DEFPROCscoredacross(t%,r%)
1110lineacross%(t%,r%)=2
1120lineacross%(t%,r%-1)=2
1130linedown%(t%-1,r%)=2
1140linedown%(t%,r%)=2
1150SC%=SC%+sc%(t%,r%):sc%(t%,r%)=0:PROCprint
1160ENDPROC
1170DEFPROCscoredup(c%,v%)
1180linedown%(c%,v%)=2
1190linedown%(c%-1,v%)=2
1200lineacross%(c%,v%)=2
1210lineacross%(c%,v%-1)=2
1220SC%=SC%+sc%(c%,v%):sc%(c%,v%)=0:PROCprint
1230ENDPROC
1240DEFPROCprint
1250VDU4:COLOUR2:PRINTTAB(1,3);SC%;:VDU5
1260fill%=fill%+1
1270ENDPROC
1280DEFPROCstillmonster
1290FORI%=0TO lv%
1300i1%=RND(7)-1:i2%=RND(10)-1:MX%(I%)=X%(i1%)-32:MY%
(I%)=Y%(i2%)+16
1310pos%=FNPT(MX%(I%)+48,MY%(I%)-44):IFpos%=1THEN1290
1320PROCmonster(MX%(I%),MY%(I%))
1330NEXT
1340ENDPROC
1350DEFPROCrandommonster
1360I%=RND(lv%+1)-1:mx%=MX%(I%):my%=MY%(I%)
1370i1%=RND(7)-1:i2%=RND(10)-1:MX%(I%)=X%(i1%)-32:MY%
(I%)=Y%(i2%)+16
1380Pos%=FNPT(MX%(I%)+48,MY%(I%)-44):IFPos%=1ORPos%=3
THEN1370
1390PROCmonster(mx%,my%):PROCmonster(MX%(I%),MY%(I%))
1400ENDPROC
1410DEFPROCundoA
1420IFdown%<>monstery%THEN1480
1430IFSGN(HORI%)=-1ANDlineacross%(HORI%,VERT%)=1 lineac
ross%(HORI%,VERT%)=0:GOTO1470
1440IFSGN(HORI%)=-1THEN1480
1450IFlineacross%(OLDX%,OLDY%)=1 lineacross%(OLDX%,OL
DY%)=0:GOTO1470
1460GOTO1480
1470MOVEX%(OLDX%),Y%(OLDY%):DRAWX%(HORI%),Y%(VERT%):GOT
O1480
1480ENDPROC
1490DEFPROCundoD
1500IFacross%<>monsterx%THEN1560
1510IFSGN(VERT%)=-1ANDlinedown%(HORI%,VERT%)=1 linedown
%(HORI%,VERT%)=0:GOTO1550
1520IFSGN(VERT%)=-1THEN1560
1530IFlinedown%(OLDX%,OLDY%)=1 linedown%(OLDX%,OLDY%)
=0:GOTO1550
1540GOTO1560
1550MOVEX%(OLDX%),Y%(OLDY%):DRAWX%(HORI%),Y%(VERT%)
1560ENDPROC
1570DEFPROCcolour
1580VDU19,11,7;0;:REM 11 white
1590VDU19,7,1;0;19,9,1;0;19,15,1;0;:REM 7,9,15 red
1600VDU19,8,4;0;19,14,4;0;:REM 8,14 blue
1610VDU19,5,3;0;:REM 5 yellow
1620VDU19,13,5;0;19,12,5;0;:REM 13,12 magenta
1630ENDPROC
1640DEFFNPT(d%,e%)
1650=POINT(d%,e%-1)
1660DEFFNpt(f%,g%)
1670=POINT(f%+32,g%)
```

SPACE QUEST — for the 16 or 48K ZX Spectrum makes use of fast machine code and high resolution colour graphics to create a fast shoot-'em-up game.

You are alone in your gleaming nuclear powered spaceship as you steer through the hazardous space lanes until, unwarned, you are attacked by the blue budgies a violent race of creatures who get their kicks out of dropping bombs on passing space ships. If you can survive long enough to kill them all you have to do is steer through and destroy a whole asteroid belt. Next you come across a band of butterfly banditos who like the budgies enjoy bombing passing spaceships. If you can destroy all of these, you have to destroy another asteroid belt and only then can you get back on the space lanes.

This game allows a large number of keys to be used; any key from Caps Shift to V is left, any key from B to spacebar is right and any key from J to Enter is fire in rounds 1 to 4 and thrust in the space lanes.

To enter the program type in listing 1 and save it to tape with

SAVE "SPACE" LINE 1

Next comes the 3K of machine code. Type in listing 2 and run it. When run it will Poke the machine code onto the screen so do not worry if the screen starts getting messy — this is because there is not enough room for the data and the machine code if stored normally. A checksum is used on the data so the computer will tell you the line of any error it finds. If an error does occur, check and correct it and rerun the program. When it Pokes in all the machine code without an error it will save the resultant code.

The program is ready

If you now rewind the cassette the program is ready. Type

LOAD ""

and after loading the Basic program it will auto run and load the machine code into the correct place.

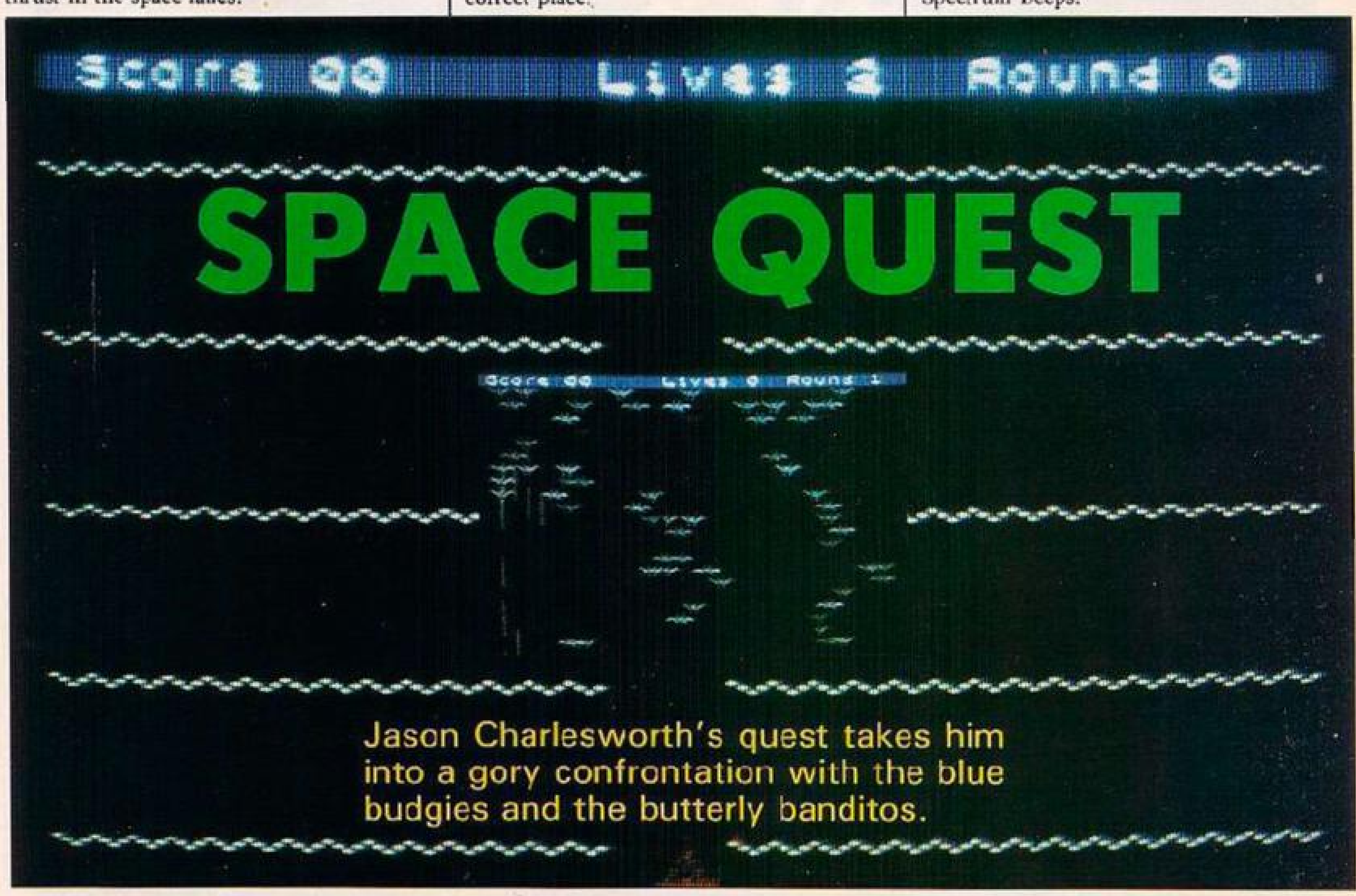
The game is now ready and the instructions should be printed on the screen. When your game is over, if you got a high enough score you will be asked for your name for the high score table. If you wait about 10 seconds when it has printed the instructions a demo mode will be played of all the rounds except the space lanes.

For those who find the game too easy or hard, here are two addresses which could help.

Address 29562 holds how many lives you start off with, normally three, so by Poking it to nine you start with nine lives.

Address 29567 holds how long the pause is. Normally the game is too fast so during the game the program uses this number as the length of the pause between moves, normally 30. A low number makes the game very fast, a high number makes the game slow.

Finally thank-you to, Robert Rhodes, a friend of mine who translated the music to Spectrum Beeps.



Jason Charlesworth's quest takes him into a gory confrontation with the blue budgies and the butterly banditos.

Space Quest — listing 1.

```
   1 POKE 23675,72: POKE 23676,1
27
  10 BORDER 0: PAPER 0: INK 7: C
LEAR 29399: LOAD ""CODE 29400
  20 DIM a$(5,10): DIM a(5)
  21 LET a$(1)="Jason C.": LET a
(1)=2730
  30 CLS : PRINT AT 0,2; INK 5;"
"; INK 6;"  "; INK 7;" space Que
st "; INK 6;"  "; INK 5;""
  40 PRINT AT 7,7;"Caps to v = L
eft";AT 9,7;"b to space = Right"
  50 PRINT AT 11,7;"j to enter =
 Fire/Thrust"
  60 PRINT AT 13,7;"h = Halt";AT
 15,7;"s = Start"
  70 PRINT AT 2,6;"By Jason Char
lesworth"
  80 FOR a=1 TO 1000: IF INKEY$=
"s" OR INKEY$="S" THEN GO TO 100
0
  90 NEXT a: RANDOMIZE USR 29400
 100 GO TO 30
1000 POKE 23300,0: LET 1=USR 295
51: LET sc=100*(PEEK 23296+256*P
EEK 23297)+10*PEEK 23298
1010 GO SUB 2000: IF NOT sc THEN
 GO TO 1060
1020 FOR a=1 TO 5: IF sc<a(a) TH
EN NEXT a: GO TO 1060
1030 IF a<>5 THEN FOR b=5 TO a+1
 STEP -1: LET a$(b)=a$(b-1): LET
 a(b)=a(b-1): NEXT b
1040 INPUT "Name please ";a$(a)
1050 LET a(a)=sc
1060 CLS : PRINT PAPER 1; BRIGHT
 1; INK 7;"          Hi-Score tab
le          "
1070 FOR a=1 TO 5: IF a(a) THEN
PRINT AT 5+2*a,5; INK 5;a$(a);"
  ";a(a): NEXT a
1080 PAUSE 200: GO TO 30
2000 LET a=20/76: LET b=a/2: LET
 c=a*3: RESTORE : FOR q=1 TO 36
2010 READ d: IF d=50 THEN PAUSE
1+INT (a*3.33): GO TO 2010
2020 READ e: BEEP d,e: NEXT q
2030 RETURN
2040 DATA a,0,c,7,50,b,0,c,7,50,
b,0,a,7,1.5*b,7,.5*b,7,a,12,a,16
2050 DATA a,7,1.5*b,7,.5*b,7,a+b
,7,50,50,a,16,a,19,a,16,a,12,a,1
9
2060 DATA b,16,b,12,a,19,b,16,b,
12,a,7,1.5*b,7,.5*b,7,a+b,7,a,0,
c,7,50,b,0,a
2070 DATA 7,1.5*b,7,.5*b,7,c,12,
c,16
```

(Listing 2 is on page 123)



Available from Dixons, John Menzies, W.H. Smith, Boots and all good computer stores.

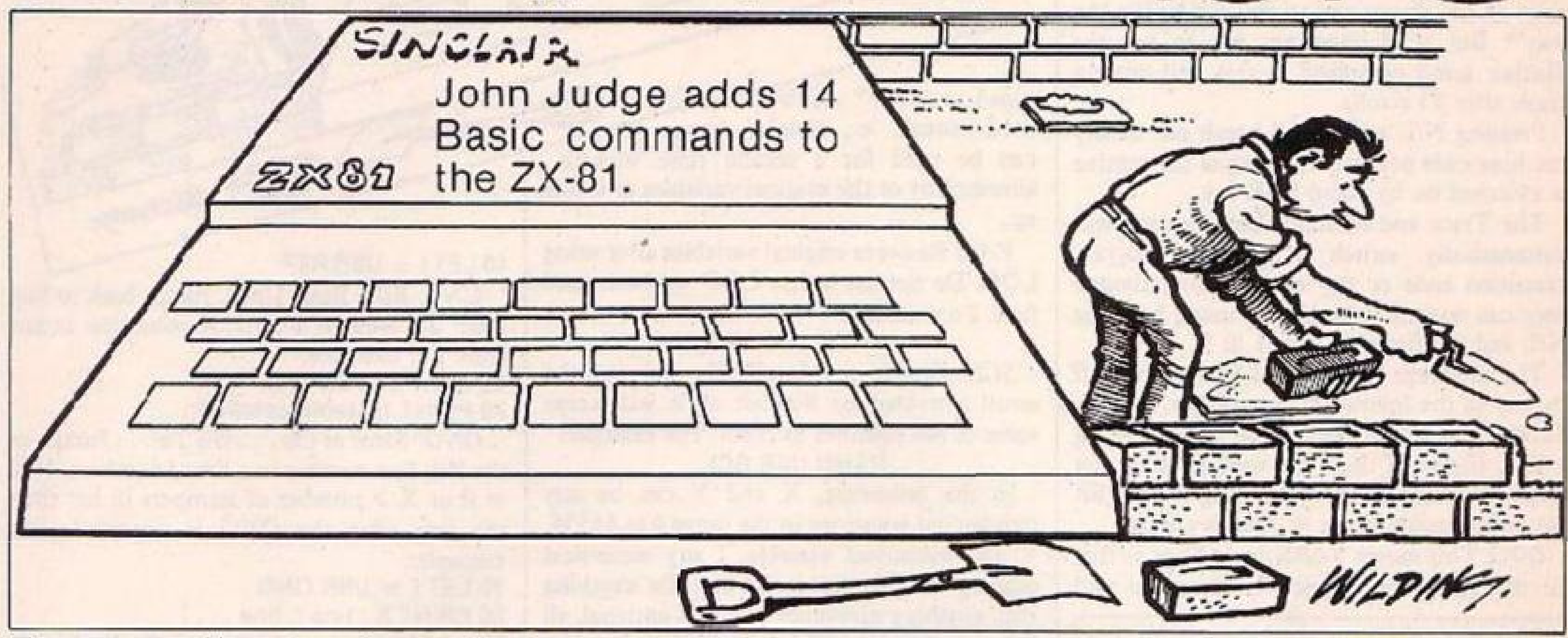
Space Quest — listing 2.

```
   1 DEF FN x(a$)=16*(CODE a$-48
-(39 AND a$(1)>"9"))+(CODE a$(2)
-48-(39 AND a$(2)>"9"))
  10 LET x=16384: FOR a=0 TO 52:
 READ a$: LET t=VAL a$( TO 4): L
ET a$=a$(5 TO ): FOR b=0 TO 63:
LET y=FN x(a$(b*2+1 TO b*2+2)):
POKE x,y: LET t=t-y:: LET x=x+1:
 NEXT b: IF NOT t THEN NEXT a: G
O TO 40
20 PRINT "error line ";a*10+100
  30 STOP
  40 SAVE "Quest"CODE 16384,3367
 100 DATA "6849cd537c3e0132045bc
dab7706c8c50e043e05328f5ccd6376c
d95793a045cfeff2073c110e8cdfc7b3
e0232045bcdab7706c8c50e0c3e03328
f5ccd4776cd2176"
 110 DATA "69623a045cfeff204ec11
0e8cd537c3e0332045bcdab7706c8c50
e083e06328f5ccd6376cd95793a045cf
eff2029c110e8cdfc7b3e0432045bcda
b7706c8c50e0e3e"
 120 DATA "723802328f5ccd4776cd2
1763a045cfeff2004c110e8c9c1c9973
2005b32015b32025b3e0332035b3e1e3
20b5bcdd475cda373cdcc74cda373cd5
a75cda373cdc473"
 130 DATA "6284cda373cd5274cda37
318e0218403113200cdb503212c01115
000cdb50321840311 3200cdb50306327
610fdc9cd537c3e0332045b97320a5bc
dab77cdb37ccd4f"
 140 DATA "713678cdd17ccd4f783a0
d5bfe00203bcd3176fe0028330e083e0
6328f5ccd6376cd9579cd4f78cd4f78c
d3176fe002819cd4f78cdd17ccd4f78c
d3176fe0028093a"
 150 DATA "55830d5bfe00200318b6c
997320d5bcd2c77212e5b06197efe0f3
803d60a7723232310f3210e5b061e360
02310fb3a035b3c32035bfe00c2d073c
1c9cdfc7b3e0432"
 160 DATA "7058045bcdab77cdb37c9
7320a5bcdd17ccd4f783a0d5bfe00203
5cd4f780e0e3e02328f5ccd4776cd4f7
8cd2176cd4f783a0d5bfe002018cd4f7
8cdd17ccd4f783a"
 170 DATA "55810d5bfe002008cd317
6fe0020bfc9212e5b06197efe0f3803d
60a7723232310f397320d5bcd2c773a0
35b3d32035bfe00208bc1c9cd537c3e0
132045b97320a5b"
 180 DATA "7685cdab77cdb37ccd4f7
8cdd17ccd4f783a0d5bfe00203bcd317
6fe0028330e043e05328f5ccd6376cd9
579cd4f78cd4f78cd3176fe002819cd4
f78cdd17ccd4f78"
 190 DATA "5235cd3176fe0028093a0
d5bfe00200318b6c997320d5bcd2c772
12e5b06197efe0f3803d60a772323231
0f3210e5b061e36002310fb3a035b3d3
2035bfe00c2d874"
 200 DATA "7025c1c9cdfc7b3e02320
45bcdab77cdb37c97320a5bcdd17ccd4
f783a0d5bfe002035cd4f780e0c3e033
28f5ccd4776cd4f78cd2176cd4f783a0
d5bfe002018cd4f"
 210 DATA "647978cdd17ccd4f783a0
d5bfe002008cd3176fe0020bfc9212e5
b06197efe0f3803d60a7723232310f39
7320d5bcd2c773a035b3d32035bfe002
08bc1c9cdab77cd"
 220 DATA "7163b37c9732045bcd127
701bc02c5cdd17ccd7f763a0d5bfe002
01acd2176cdc076cdd17c3a0d5bfe002
00ac10b97b920dcb820d9c9c197320d5
bcd2c773a035b3d"
 230 DATA "584232035bfe0020b5c1c
93a0b5bfe00c847c5060010fec110f8c
9212d5b06197e232323e680fe8020041
0f497c93e01c93a0a5be602fe0220040
60218020601cd09"
 240 DATA "56367b3a0a5b3ce603320
a5bc93a0a5be602fe022004060218020
601cd6c7b3a0a5b3ce603320a5bc93a0
55b4ff5fea730030c0c0cc501febfed7
8e60fc1fe0f280c"
 250 DATA "55430d0d0d0d0d3e3cb93
8020e3cf1b9c8c5ed4b055b1e01cd5e7
dc11e003a065b47cd5e7d7932055bc90
605212d5bc5e54e2346cd077a0c0c0c7
9febd382e0e0823"
 260 DATA "6050234697b820043a2e5
b47cdde7b7de6036fcb7c28057885471
80378954778fe1c3802061c78fe03300
20603e1e5712370cdad7ae12323c110b
4c9010e0021ce77"
 270 DATA "5685112d5bedb0c9080f2
d0f520f760f9b0f000000000640c5783
de607328f5ced4b055b971e00cdac7d7
9c6084f3e02cdac7dc1c5783de607672
42e01110500cdb5"
 280 DATA "734303c110d23e07328f5
c3e0fed4b055bf5ccde7be5c57ce6036
723110a00cdb503c1e17ce60732f77f7
de6e032ff7f1e003e15cdac7d9732f77
f32ff7f1e013e15"
 290 DATA "70837ecdac7d0df13dfe0
020c43e151e00cdac7dc93e07328d5cc
d6b0dcdcd1f21e677062 33e4f328f5c7
ed72310fb3e16d797d73e14d73a035bc
630d73e16d797d7"
 300 DATA "51923e1dd73a045bc630d
797cd0978c91600002053636f7265202
0202020202020204c6976657320202020205
26f756e6420202020e5c5f5473a025b2
a005b80fe0a3803"
 310 DATA "6113d60a2332025b22005
b473e4f328f5c3e16d73e00d73e07d79
7bc2003bd2807ed4b005bcd1b1a3a025
bc630d73e30c797320f5cf1c1e1c93a0
75bfe00201e01fe"
 320 DATA "5137bfed78e60ffe0fc83
e0132075b2a055b2d2d2d2d242424242
2085bc9ed4b085b1e013e11cd727e0d0
d0d0d3e08b938059732075bc9ed43085
bc5040404cd5b7e"
 330 DATA "6218fe00202704cd5b7ef
e00201f0ccd5b7efe0020170c0ccd5b7
efe00200e3e07328f5c1e003e11c1cd7
27ec9c13a045be601fe01285f78e6f81
f1f1f4779e6f81f"
 340 DATA "53081f1f4f212d5b1e197
e2323feff283e7eb8203a2b7e23b9203
42b2b3effcd6b7a3a045bcd097897320
75b234e23463e02328f5c3e12cd237a3
e06328f5c3e13cd"
 350 DATA "6227237a3e00328f5c3ef
fcd237ac9231d97bb20b5c978c603e5f
01f1f1f4779e6f81f1f1f4f212d5b1e1
97e2323feff28462b7e23b920407eb32
8093db628053c3e"
 360 DATA "5889b8203397320 75b2b2
b36ff234e2346cd6b7a3a045bcd09733
e02328f5c3e12cd107a3e03328f5c3e1
3cd107a97328f5c3effcd107ac9231d9
7bb20adc9210e5b"
 370 DATA "4776060ac57efe0028232
34e23461e013e10cd727e79c6044ffeb
438062b2b3600180f2b711e003e07328
f5c3e10cd727e2bc123232310cc210e5
b112d5b060ac57e"
 380 DATA "4872fe00202d1ae680fe8
0200d1313133e76bb30f1112d5b18ec1
31aa7171717 4f131aa7171717c605471
33601237123702b2bc123232310c7c9c
d237a043c20013d"
 390 DATA "7154cd237a053dfefe200
13cc9e5c5d5f5feff200511003d1b10e
d5b7b5ca7cb17cb17cb17833001145f7
8e61fcb17cb17cb174779e61fcb17cb1
7cb174fcd227f3e"
 400 DATA "73518f5c77cd027fC6081
a13772410faf1d1c1e1c9e5d5c5f5063
22119001101 00e5d5c5cdb503c1d1e12
32310f3f1c1d1e1c9e5d5c5f550C603c
50600cd027f061d"
 410 DATA "6097780ba2003232323360
02310f4c10c10e8f1c1d1e1c9e5d5c5f
5500600cd027f061d7ab820032323239
7bec4017b36c02310ef0c0600cd027f0
61d7ab820032323"
 420 DATA "59852397bec4017b36332
310ef0c0600cd027f061d7ab82003232
32397bec4017b360c2310eff1c1d1e1c
9f53e01320d5bf1c93e02b820010c783
27c5b79327d5b06"
 430 DATA "6604192121d5bc53a7c5bb
e203e234e23463effcd237ae5cdde7be
be10c79fe1638020e0170fe803010e60
23d8047fe2020014678feff200146702
b713a7d5bcb4728"
 440 DATA "6248033d18013ccd237a2
b7eee0377232323c110b1c93e02b8200
20c0c78327c5b79327d5b212d5b0619c
53a7c5bbe204c234e23463effcd107ae
5cdde7bebe17be6"
 450 DATA "5448023d5f7ae6023d577
0834779824f2bfe0020014e79fe16200
14e2378fe0020014678fe1e200146702
b712b3a7d5bcb4f28043d3d18023c3cc
d107a7eee0377c1"
 460 DATA "589323232310a3c9f5c52
92929292929292 9ed4b765c0901e5430
9ed4b735c0922765cc1f1c921087c112
d5b014b0Cedb0c9ff1013ff010fff070
8ff0505ff091301"
 470 DATA "0788061c010304010801 0
1030601020702041b020b08020a16010
914020603020f04020113020a0c02100
f02090401100d01031101021d0203150
2061a216E7c112d"
 480 DATA "18325b014b00edb097210
e5b061e7710fdc90103050103 0a01030
f01031401031902050402050902050f0
205150205 1a01070501070a01070f010
714010719020907"
 490 DATA "369902090c02091202091
7010b0a010c0f010b14020d09020d150
10f0f21cc7c11055b010500edb0ed4b0
55b1e00cd5e7d97320d5bc9a7780000 0
097ed4b055bcd80"
 500 DATA "74017d3effcd807d3e01c
d807dcd267d97bac002020202ed4b055
b6f78fe00200a7dfe0428C597cd807dc
978fef020067dfe042001c91e01cd5e7
d1e007d8047ed43"
 510 DATA "8399055bcd5e7d7acd807
d97cd807dc9c5f501feb fed78e610fe0
0200b01fefded78e602feC020f511000
001fefeed78e61ffe1f280216ff01fe7
fed78e61ffe1f28"
 520 DATA "6197021601f1c1c997bb2
8073e07328f5c18053e02328f5c97cda
c7d79c6084f3e02cdac7d79d6084fc9d
5c557fe0120063e0f804716ff1e0fcd5
b7efe002805320d"
 530 DATA "71505b180e3effba20030
c1801041d97bb20e6c1d1c9f5c5d5e52
a7b5c87878785300124 6fe5dde17b32b
05c3a8f5c5f1607788247cd227f7378c
60847cd227f737a"
 540 DATA "718681 4fcd227f7378d60
847cd227f737892 47cd227f7379924fc
d227f73cd027f32b15c7a08c5ed4bb05
cdd5e00dd560077b02000e7cb1bcb1a1
f10f94797b92810"
 550 DATA "64027b2fa677237a2fa67
723782fa677180 67eb377237eb277237
eb077dd232b2b7cc13ce60720060ccd0
27f0d25240c79febf20050e00cd027f0
83dfeff20a5e1d1"
 560 DATA "8094c1f1c9c5e5cd027f4
eee0747fe002804cb1910fc79e601e1c
1c9f5c5d5e52a7b5c878787853001246
fe5cde17b32b05c3a8f5c5f160778824
7cd227f737a814f"
 570 DATA "7032cd227f73789247cd2
27f7379924fcd227f73cd027f32b15c7
a08c5ed4bb05cdd5e009757b82807a7c
b1bcb1a10fab9280b7b2fa677237a2fa
677180 77eb37723"
 580 DATA "71367eb277dd232b7cc13
ce60720060ccd027f0d25240c79febf2
0050e00cd027f083cfeff20b4e1d1c1f
1c979e6c01f1f1f6779e63817176f79e
607E4c6406778e6"
 590 DATA "4042f01f1f1f856f78e60
7c90879e6f826006f292978e6f81f1f1
f856f3e58846708c9000000000000000
00000000000000000101010303060 50
0000008080c040"
 600 DATA "68294c4c5b7f7c7942056
464b4fc7c3c844002027bfd87040a004
040debfe120500004 62bb1d070402022
046cdb8e02040407289b5c3c1b38d714
e71adc383cdb18e"
 610 DATA "5998021925 2b292b25194
098a4d494d4a4981c1e7effff7e78100
83c7efe7f7e1c183c7ee7dbdbe77e3c3
c7ee7c3c3e77e3c000000101010 28101
02828101028 0000"
 620 DATA "616000002418182400000
03c42424242 3c00c3c324000024c3c30
078eedbdfff7d0000 1e7de7fbffbe002
15c1b095e2356237ab32836eb09d5e55
e2356eb09ebe173"
```



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BETTA BASIC



THIS SET OF machine-code routines provides the 16K ZX-81 with 14 new Basic statements and commands usually found only on much larger and more expensive machines. The routines take up 1336 bytes in a Rem statement and are designed for ease of use with full error codes. Two of the routines are interrupt driven and allow you to add your own interrupt driven routines.

To enter the program, a 16K ZX-81 with the New run has to be used, it may be possible to use less memory, but some of the routines will crash if the display file is collapsed, ie., RAM is less than 3¼K.

First, line 1 Rem followed by 128 zeros — four lines — is entered. This is then duplicated as line 2 and so on up to line 10. When this has been done, the following are entered as direct commands.

```
POKE 16511,56
POKE 16512,5
POKE 16509,0
POKE 16510,0
POKE 16514,118
POKE 16515,118
1 REM BETTA BASIC
POKE 16419,1
NEW LINE
```

You should now have

```
1 REM BETTA BASIC
```

on the screen. Anything else means that you have probably done something wrong and it is best to start again.

If all is well then enter the hex-loader program 1, ignoring line 0 as this should already be in memory. Type Run N/L then enter the start address for the machine code data, which will be 16514 if you are just starting or another number if you are continuing from another day or after saving partly completed data. You can now enter the hexadecimal data, as many of the numbers as you like before pressing Newline, but remembering not to enter any of the spaces. There is a check-sum number after each line of data which you can compare with the check-sum number on the screen, if it is different then press S N/L and you can enter the line that is wrong. By pressing Q N/L, you can break out of the program to save it.

Looking through data

Program 2 is for looking through the data for any that is wrong. To use it, type Run 200 then enter the start address. Type Cont after each screenfull.

If all the data is entered and correct, then delete lines 5 onwards and enter program 3. Do not use New to delete the lines. The program is now finished and ready to use, unless some bugs have escaped detection.

You must have Betta Basic present in the computer before you start typing in your program. In this way the machine code routines are saved as you save your program that uses them. Now, whenever you type Run, the variables are initialised ready for use.

INT: Switches on the interrupt routine by Rand USR Int to give the following features:

TRACE ON by POKE TRN, 1 or pressing N/L and 1 together;

MEMORY ON by POKE TRN, 2 or pressing N/L and 5;

MEM/TRACE OFF by POKE TRN, 0 or pressing N/L and 2;

ROUTINE OFF by pressing N/L and 3 or Fast then Slow;

Break out of any program — even machine code — by pressing N/L and 4. This also switches routine off;

TRACE SPEED by POKE LEN, n where n is the length of the pause at each interrupt. Initially 3;

USER ROUTINE: Three bytes — USE, USE + 1 and USE + 2 — are set aside to add to call to your own interrupt driven routine. Initially all are NOPS. Make sure the routine is Off by using Fast followed by Slow before you start Poking or a crash will occur as soon as you Poke in the first number.

When using the trace or memory left

(continued on next page)

Program 1.

```
   1 REM 000000 ETC....
   5 SCROLL
   8 SCROLL
  10 PRINT AT 18,0;"START ADDRES
S?"
  15 LET A$=""
  20 INPUT S
  30 FOR X=S TO 17795 STEP 7
  40 SCROLL
  50 PRINT AT 19,0;X;
  55 LET C=0
  60 FOR T=X TO X+6
  70 IF A$="" THEN INPUT A$
  80 IF A$="S" THEN RUN
  84 IF A$="Q" THEN STOP
  86 IF LEN A$/2<>INT (LEN A$/2)
 THEN LET A$=""
  88 IF A$="" THEN GOTO 70
  90 LET N=16*CODE A$+CODE A$(2)
-476
 100 POKE T,N
 110 LET C=C+N
 120 PRINT " ";A$( TO 2);
 125 LET A$=A$(3 TO )
 130 NEXT T
 140 PRINT ", ";C
 150 NEXT X
```

(continued from previous page)

features, the number will take up the first five characters in the top left corner of the screen. These numbers are only printed up during the interrupt and the original text or graphics are put back into the screen before control is handed back to the ROM. So as far as the ROM is concerned, the numbers do not even exist on the screen and so will not be "in the way". But it is important not to use the Sinclair scroll command as this will cause a crash after 23 scrolls.

Pressing N/L and 4 will break out of any machine code programs as long as the routine is switched on by Rand USR Int.

The Trace and Memory Left routines will automatically switch off when program execution ends or any error occurs, though they can operate in command mode by using N/L and the function keys 1 to 5.

The interrupt routine will be switched off by any of the following: Fast, Copy, LPrint, LList, Save, Load, Pause, New or by entering a line. If any of these are used then do not forget to switch on again by using Rand USR Int before using Trace or Memory Left.

LOC: This moves VARS up to Eline so that all the variables temporarily disappear and "load variables" can be used instead, i.e., variable names can be used for a second time without altering any of the original variables of values eg.,

VAR: Restores original variables after using LOC. Do not use unless LOC has been used first. For example

FAND USR VAR.

SCL: Stands for Scroll. Do not use the scroll provided by Sinclair as it will cause some of the routines to crash. For example:

RAND USR SCL.

In the following, X and Y can be any numberical argument in the range 0 to 65535, V any numerical variable, I any numerical dummy variable that is not used for anything else, anything surrounded by [] is optional, all Print statements will be changed to Rem by the routine, and should be changed back to Print if ever the line is edited. The Print lines after the USR lines hold the arguments for each routine.

ERROR CODES.

- Z variable not found, eg., R$ in Rep, Proc name etc
- 4 out of memory
- B integer out of range, ie a number less than 0 or greater than 65535 has been used in a routine
- C number error, ie a number or expression has been left out or does not make sense so the computer can not change it to an integer for it to use.
- D break
- Q missing ;
- R too many repeats (max 17)
- S syntax error, eg no data or expressions
- T missing
- U until without repeat
- V R$ error eg., R$ has been DIMed or is too short so that Rep and Unt can not use it.
- W Rand too high for LST
- X Proc name error, eg too short (minimum three characters or non-existant
- Y incorrect string variable in line after DYN

Function has three uses

PRT: This has three uses, two of which are concerned with the ports.

a) OUT (port), byte. For example:

10 LET I = USR PRT
20 PRINT X, Y [; X, Y . . . . .]

b) IN variable, (port) or LET variable = IN (port). For example:

10 LET I = USR PRT
20 PRINT; X where X = port 0 to 255

c) LD I, X. For example:

10 LET I = USR PRT
20 PRINT; X where X = char set 0 to 255

This one changes the character set and can be used for games or with a graphics ROM — initially 30.

REP: Same as BBC Basic Repeat. The line numbers are stored in R$. Up to 15 Repeats can be nested — inside each other — before an error occurs. For example:

10 LET I = USR REP

UNT: BBC Basic Until. Jumps back to line after last Rep. If a testable condition is not true. For example.

10 LET I = USR UNT
20 PRINT testable condition

ONG: Same as On . . . Go To . . . Jumps to the Xth line number in a list of numbers. If X = 0 or X > number of numbers in list then the line after the ONG is executed. For example:

10 LET I = USR ONG
20 PRINT X ; line [, line . . .]

Up to 255 lines can be put on the list.

PRC: Def Proc. This is a simulation of procedures, using names instead of line numbers. Each 'procedure' has the following structure:

10 REM PROCNAME
20 Subroutine or procedure
30 RETURN

where Name will be the name of the procedure. PRC is called only once at the beginning of the program. For example:

10 LET I = USR PRC

The routine then searches for all the "Rem Procname"s and puts the names into the variables area with their line numbers so that a procedure can be called by:

GOSUB NAME

The name must be three or more characters long and contain only characters legal as a variable name, see page 38 of the Sinclair manual. There is no space between the Proc and the Name.

DYN: Dynamic procedure. This routine tells you whether a name held a string variable is a procedure or not so that it may be used with VAL without an error occuring. If it does not exist. eg.,

10 INPUT A$
20 IF USR DYN THEN GOTO VAL A$
30 REM A$
40 GOTO 10

The above example Gotos a procedure entered in line 10 if it exists, otherwise it waits for you to enter another. The A$ in lines 10, 20 and 30 can be changed to any other string variable.

LST This is a fast scrolling list with a few extra features. To use:

Rand line to list from Rand USR LST

In this routine you can press:

Space to break out of the routine;

Z to copy the screen to the printer;

K to "normal list" the last line on the screen in order to edit;

D to list through slowly;

(continued on page 131)

Program 2.

```
190 STOP
200 PRINT "START ADDRESS ?"
210 INPUT I
220 FOR X=I TO 17795 STEP 7
230 PRINT X;
240 LET C=0
250 FOR T=X TO X+6
260 LET N=PEEK T
270 LET C=C+N
280 PRINT " ";CHR$ (INT (N/16)+
 28);CHR$ (N-16*INT (N/16)+28);
290 NEXT T
300 PRINT ". ";C
310 NEXT X
```

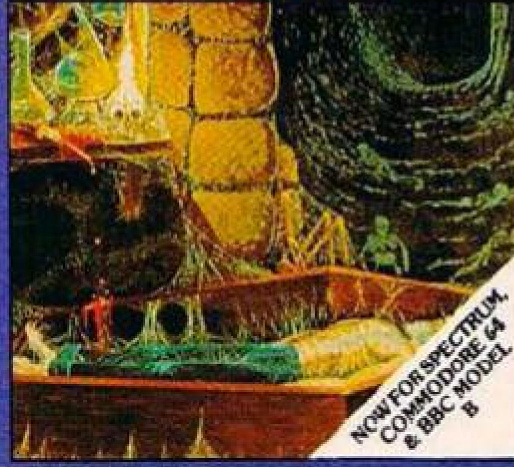


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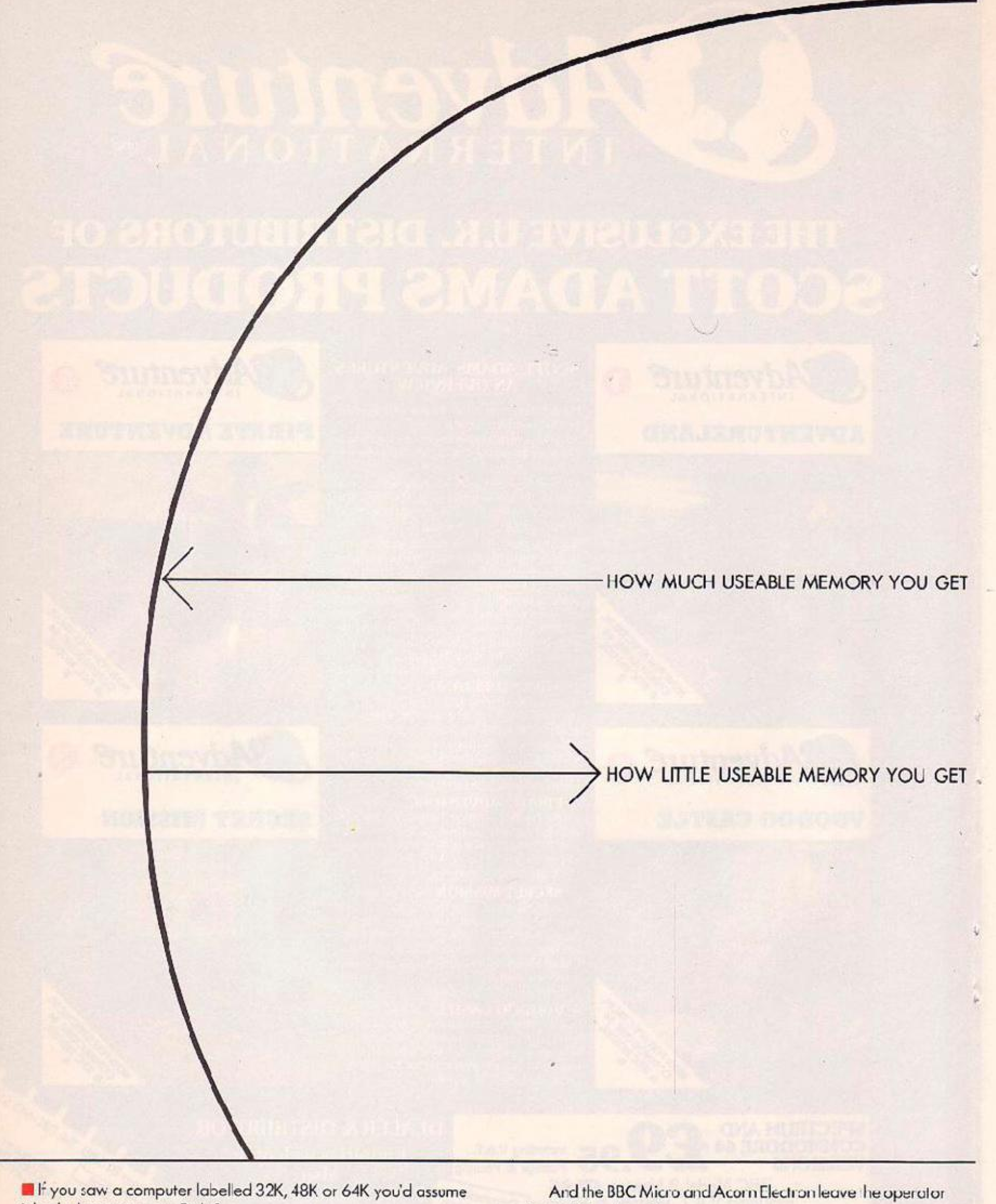
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If you saw a computer labelled 32K, 48K or 64K you'd assume it had a large memory. Right?

Wrong. These figures bear little relationship to the actual amount of useable memory left once the computer is performing functions like text, colour, sound and even more importantly, high resolution graphics.

The Commodore, for instance, claims an "elephantine" 64K memory, yet uses up 26K producing high resolution graphics.

Under the same conditions, the Dragon 32K leaves 24K of useable memory, the Lynx 48K just 14K.

And the BBC Micro and Acorn Electron leave the operator a miserly 9K to play with.

However, there is one computer specifically designed to cope with these normal working functions as a matter of course.

The new Oric Atmos 48K.

Why, even when you add peripherals like the new micro disc drive unit and colour printer (see technical details overleaf), its useable memory is never less than a healthy 37K.

Which not only caters for all the standard applications you'd expect from any home computer, but also for advanced

WITH THE NEW ORIC ATMOS.

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programming and very sophisticated games.

Talking of games, the new Oric Atmos starts off with a major advantage over most new computers, since it takes most of the software already written for the Oric-1.

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The same unit, in fact, that prompted "Which Micro" (November) to quote... "At full volume this machine can compete with most arcade games. Its sound facilities have more in common with the £400 Beeb, than the rather pathetic beep of the Spectrum..."

Yet the Oric Atmos 48K costs a modest £170, including all the leads and adaptors you need to get it going.



But then what else would you expect from a British Company recognised for offering so much for so little?

The new Oric Atmos 48K.



Now we've whetted your appetite, here's something to get your teeth into.

Printer Technical Specifications

Printer/Plotting system	Ball Point Pen, 4 colour
Plotting speed: (horizontal)	52 mm/sec (2.05ips)
(vertical)	73 mm/sec (3.08ips)
Printer Speed	12 characters per second
Resolution	0.2 mm/step (0.00787 inch)
Effective plotting range	96 mm (3.804 inch) x axis, divided into 480 steps. (No limit in y direction)
Characters per line	80 or 40 text mode (determined by software in graphics mode)
Characters per line	INT (480/n+1) *6) for 0=n=15
Accuracy (repetition)	0.2 mm max
(movement)	0.3 mm max
(distance)	0.5% max (x–axis) 1% (y–axis)
Pen life	250 metres (825 feet)
Parallel interface	8–bit parallel Uses STROBE and ACKNOWLEDGE
Temperature range	18.3 to 35°C (65 to 96°F)
storage	–40 to 71°C (.40 to 160°F)
Humidity range	10% to 80% relative non-condensing
Power supply	Switching power supply input 100–120 VAC 200–240 VAC
Dimensions	10¾" wide 5⅞" deep 2½" high

Atmos Technical Specifications

CPU	6502 A
Memory	Choice of 16K or 48K RAM
Memory (48K Model)	Minimum 48K RAM, max 64: 16K ROM external control signals allow use of full 64K RAM or maybe used externally to increase ROM/RAM
Language	Extended Microsoft basic
Keyboard	Typewriter style and pitch, 57 keys, standard computer layout, additional cursor control keys, autorepeat facility, tactile and acoustic feedback
Display	Output for B&W or colour TV, RGB output for colour monitor.
Text format	40 in ex 28 rows
Character set	Similar to Teletext format, standard ASCII double height, flashing, 80 user definable characters
Graphics	240 x 200, 8 colours
Graphic Facilities	Points, lines, circles
Sound	Internal loudspeaker and amplifier. 3-Channel sound synthesiser envelope control, amplitude control 8 octaves, noise channel
Storage	Most cassette recorders via DIN socket 300 or 2400 BAUD. Disc Drive.
Interface	Centronics, expansion port, Hi-fi, RGB Monitor, UHF TV, cassette recorder
Other	Warm reset to regain control without clearing program or data

Micro Disc Technical Specifications

Formatted Capacity	160K bytes per side (double density as standard)
No. of Tracks	40 (80 available as option at a future date)
No. of Sectors	16
Bytes per Sector	256
Transfer Rate	250K Bits/Sec

Supports up to 599 files per side, four drives single or double sided, 40 or 80 track. User definable configuration allows mixing of drive types including 5¼" (five and a quarter inch)
Extensive wild card facilities
Copy allows merging of basic and machine code files

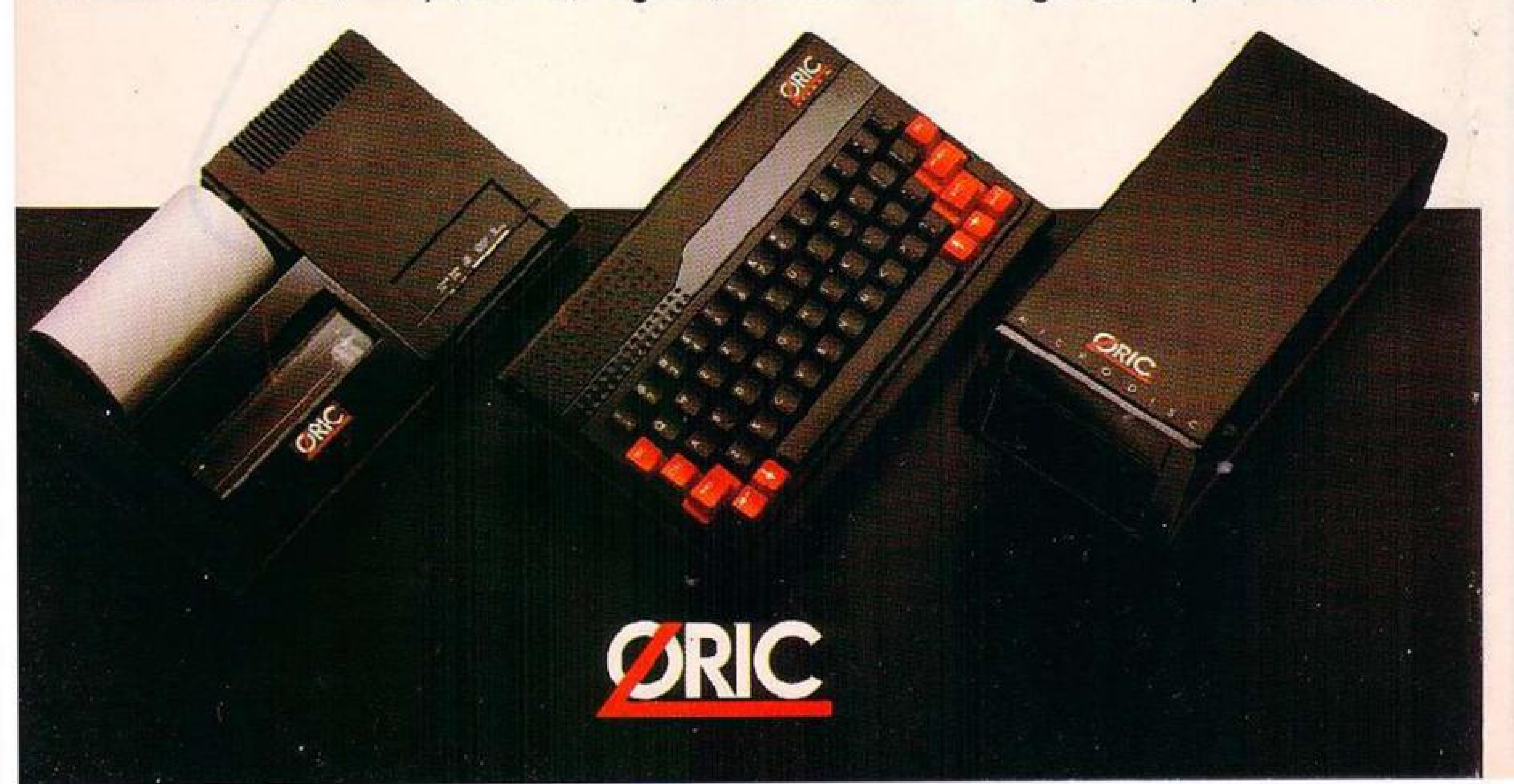
Utilities

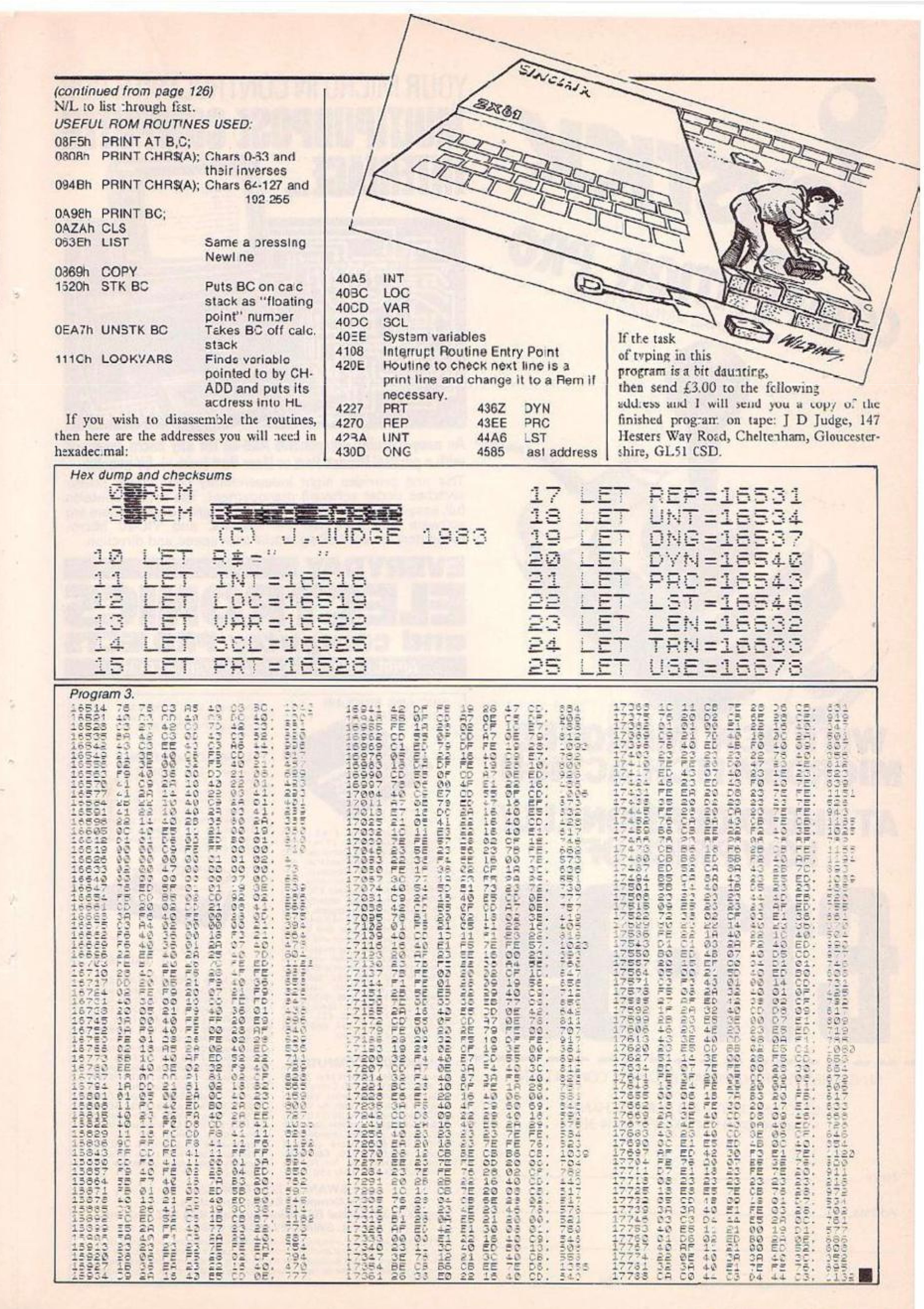
The Utilities are as follows:

1. Backup	Copy a whole disc
2. Copy	Copy a file to another
3. Del	Delete a file allowing wildcards
4. Dir	Display directory listing
5. Drv	Set the default drive number
6. Format	Format and initialise a disc
7. Load	Load a file (code data or basic)
8. Protect	Change protect status of file
9. Recall	Recall a basic array from a file
10. Ren	Rename a file
11. Save	Save a file (code, data or basic)
12. Store	Store a basic array as a data file
13. Sys	Change system configuration

Prices and data correct at time of going to press.
Specifications on the above models may change without notice.

Available at Dixons, Laskys, Comet, Wigfalls, Rumbelows and all good computer stockists.





(continued from page 126)
N/L to list :hrough fast.

USEFUL ROM ROUTINES USED:

08F5h	PRINT AT B,C;	
0808h	PRINT CHR$(A);	Chars 0-63 and their inverses
094Bh	PRINT CHR$(A);	Chars 64-127 and 192 255
0A98h	PRINT BC;	
0AZAh	CLS	
063Eh	LIST	Same a pressing Newline
0369h	COPY	
1520h	STK BC	Puts BC on calc stack as "floating point" number
0EA7h	UNSTK BC	Takes BC off calc. stack
111Ch	LOOKVARS	Finds variable pointed to by CH-ADD and puts its address into HL

If you wish to disassemble the routines, then here are the addresses you will need in hexadecimal:

40A5	INT		
40BC	LOC		
40CD	VAR		
40DC	SCL		
40EE	System variables		
4108	Interrupt Routine Entry Point		
420E	Routine to check next line is a print line and change it to a Rem if necessary.		
4227	PRT	436Z	DYN
4270	REP	43EE	PRC
423A	UNT	44A6	LST
430D	ONG	4585	ast address

If the task of typing in this program is a bit daunting, then send £3.00 to the following address and I will send you a copy of the finished program on tape: J D Judge, 147 Hesters Way Road, Cheltenham, Gloucestershire, GL51 CSD.

Hex dump and checksums

```
 0 REM
 3 REM [illegible]
       (C) J.JUDGE 1983
10 LET R$=""
11 LET INT=16516
12 LET LOC=16519
13 LET VAR=16522
14 LET SCL=16525
15 LET PRT=16528
17 LET REP=16531
18 LET UNT=16534
19 LET ONG=16537
20 LET DYN=16540
21 LET PRC=16543
22 LET LST=16546
23 LET LEN=16532
24 LET TRN=16533
25 LET USE=16578
```

Program 3.

16514	76	76	C3	A5	40	C3	BC.	1042
16521	40	C3	CD	40	C3	DC	40.	[illegible]
16528	C3	27	42	C3	7D	42	C3.	880
16535	BA	42	C3	0D	43	C3	32.	880
16542	43	C3	EE	43	C3	A6	44.	808
16549	21	3B	40	CB	F5	CD	07.	817
16556	02	3E	00	32	F5	40	21.	457
16563	F9	40	36	00	D3	21	08.	699
16570	41	C9	2A	10	40	22	01.	483
16577	41	2A	14	40	22	03	41.	283
16584	2B	22	10	40	CB	2A	01.	461
16591	41	22	10	40	2A	03	41.	388
16598	22	14	40	2B	35	80	2A.	155
16605	0C	40	ED	11	21	00	19.	350
16612	01	01	D6	00	ED	B0	01.	810
16619	00	00	C9	FE	FF	00	00.	710
16626	00	00	00	00	01	01	02.	4
16633	02	00	47	00	00	00	00.	73
16640	00	00	00	00	00	27	00.	55
16647	76	ED	5F	01	01	19	3E.	530
16654	FE	CD	BB	02	CD	92	02.	886
16661	CD	20	02	CD	21	00	41.	588
16668	3A	F6	40	FE	00	28	0C.	575
16675	C3	A4	02	06	00	00	21.	394
16682	F6	40	35	00	16	F3	21.	564
16689	F6	40	36	01	2A	07	40.	475
16696	22	EE	40	2A	25	40	7D.	604
16703	FE	E7	20	CB	7C	FE	ED.	1121
16710	28	40	FE	F6	28	4F	FE.	897
16717	DD	20	05	21	F9	40	36.	658
16724	02	FE	F0	20	07	21	F9.	828
16731	40	36	00	10	C3	FD	FD.	847
16738	20	05	21	F9	40	36	01.	436
16745	3A	00	40	FE	FF	20	E9.	896
16752	3A	F9	40	FE	00	28	AF.	840
16759	FE	01	28	26	FE	02	28.	520
16766	02	18	A5	2A	02	40	ED.	536
16773	5B	1C	40	AF	ED	52	22.	711
16780	EE	40	3E	02	32	F9	40.	729
16787	1A	DD	[illegible]	21	81	02	CF.	823
16794	1A	DD	21	01	02	18	32.	585
16801	01	05	00	2A	0C	40	23.	159
16808	11	FC	40	ED	B0	2A	0C.	800
16815	40	23	22	FA	40	2A	EE.	767
16822	40	11	FC	D8	CD	F8	41.	1033
16829	11	18	FC	CD	F8	41	11.	828
16836	9C	FF	CD	F8	41	11	F6.	1156
16843	FF	CD	FC	41	11	FF	FF.	1330
16850	CD	F6	41	11	00	01	3A.	581
16857	F9	40	FE	02	28	04	ED.	880
16864	5B	F7	40	18	7A	B3	20.	782
16871	FB	01	0E	03	ED	5B	0C.	597
16878	40	13	21	41	40	ED	B0.	848
16885	D3	26	41	AF	19	3C	38.	811
16892	FC	ED	32	C5	1B	CB	B7.	1182
16899	E5	2A	FF	40	77	23	28.	775
16906	F9	40	F1	C8	EA	2D	40.	887
16913	23	23	23	23	7E	FE	EB.	784
16920	20	05	FE	FB	28	02	CF.	794
16927	1B	38	EA	23	22	18	40.	470
16934	C9	2A	18	43	E5	CD	0E.	777
16941	42	DF	FE	19	26	47	CD.	884
16948	55	0F	CD	A7	0E	C3	[illegible]	805
16955	FE	1A	28	02	CF	10	E7.	788
16962	CD	55	0F	CD	A7	0E	79.	812
16969	C1	ED	79	DF	FE	19	28.	1092
16976	05	E1	22	16	40	C9	E7.	782
16983	18	DA	DF	FE	19	28	10.	800
16990	CD	55	0F	CD	A7	0E	ED.	926
16997	78	0E	00	4F	E1	22	16.	485
17004	40	C3	E7	CD	55	0F	CD.	1006
17011	A7	0E	79	ED	47	18	EF.	873
17018	E7	1A	DC	2A	16	40	E5.	832
17025	21	05	41	E5	16	40	CD.	428
17032	10	11	E3	E5	16	40	E1.	617
17039	7E	FE	E7	28	02	CF	1E.	748
17046	23	5E	23	56	23	78	FE.	662
17053	22	3E	F4	FE	16	00	7E.	573
17060	FE	1F	36	24	CF	1A	3C.	636
17067	3C	77	13	C3	FE	[illegible]	[illegible]	551
17074	40	54	5D	E1	73	23	72.	730
17081	C9	2F	15	40	E5	CD	0E.	777
17088	42	CD	55	0F	CD	A7	0E.	787
17095	78	B1	20	02	18	02	3E.	419
17102	01	F5	21	C5	11	22	1E.	405
17109	40	CD	1D	11	F1	E3	2E.	915
17116	16	40	E1	F5	7E	FE	57.	1023
17123	20	AF	23	EE	16	00	21.	391
17130	23	7E	[illegible]	[illegible]	[illegible]	A4	[illegible]	782
17137	7E	FE	02	28	28	CF	1C.	847
17144	F1	FE	01	28	29	19	5E.	658
17151	28	5E	E3	2A	29	40	C9.	712
17158	7E	0E	33	36	EB	77	C9.	855
17165	2A	16	40	E5	CD	0E	42.	642
17172	CD	55	0F	CD	47	0E	78.	811
17179	FE	00	23	2E	79	FE	00.	707
17186	28	22	32	F5	10	CF	FE.	917
17193	19	28	0E	CF	19	3E	00.	361
17200	32	F4	40	E7	CD	55	0F.	694
17207	CD	A7	0E	3A	F4	40	3C.	812
17214	32	F4	40	87	3A	F5	40.	823
17221	BC	23	10	DF	FE	1A	28.	787
17228	E6	E1	22	16	40	06	00.	581
17235	3A	F5	40	4F	C9	50	69.	545
17242	CD	D3	09	22	29	40	18.	593
17249	EB	2A	16	40	E5	2A	29.	578
17256	40	23	23	23	23	7E	FE.	584
17263	EA	20	18	23	7E	FE	76.	523
17270	28	12	CB	BE	CB	B6	CB.	1039
17277	EE	23	7E	FE	0D	20	06.	704
17284	23	7E	FE	76	28	02	CF.	782
17291	20	26	28	22	16	40	CD.	440
17298	1C	11	CB	7E	20	03	CE.	817
17305	76	23	04	CB	6E	23	03.	517
17312	CF	23	23	4E	23	46	78.	578
17319	E1	23	04	E5	21	60	00.	581
17326	AF	ED	42	E1	30	06	01.	780
17333	00	03	E1	22	16	40	C9.	543
17340	23	11	3C	40	ED	40	13.	503
17347	3E	74	12	21	3C	40	C6.	553
17354	BE	CB	B6	CB	EE	7E	D6.	1355
17361	26	33	E0	22	16	40	CD.	540
17368	1C	11	CB	7E	28	36	CB.	831
17375	76	20	D2	CB	6E	28	CE.	919
17382	01	01	00	E1	22	16	40.	347
17389	C9	21	70	40	18	0C	2A.	501
17396	78	40	ED	4B	F0	40	09.	807
17403	23	23	23	23	22	75	40.	356
17410	7E	FE	20	D0	47	83	4E.	618
17417	ED	43	07	40	23	1E	23.	523
17424	46	23	ED	43	F0	40	7E.	839
17431	FE	EA	20	D8	23	7E	FE.	1151
17438	35	20	D2	23	23	7E	FE.	824
17445	FE	20	20	CA	23	7E	FE.	943
17452	76	CA	8A	43	CB	FE	CB.	1155
17459	B6	CB	EE	22	F2	40	3E.	1025
17466	7A	23	AF	2A	0A	42	AF.	782
17473	CB	B6	18	F6	2B	CB	FE.	1155
17480	CB	B6	ED	5B	F2	40	AF.	1131
17487	ED	52	CA	3A	43	2B	70.	893
17494	B5	CA	8A	43	23	E5	ED.	1039
17501	5B	23	40	18	C5	23	23.	485
17508	23	23	23	23	23	4D	EB.	520
17515	09	E3	23	23	23	AF	ED.	788
17522	72	38	02	CF	03	E1	38.	661
17529	F6	23	22	14	40	23	36.	670
17536	FE	E2	1A	40	22	1C	40.	501
17543	D1	C1	03	2A	F2	40	ED.	880
17550	B0	ED	48	07	40	D5	CD.	877
17557	20	15	EF	C0	34	D1	01.	740
17564	05	00	21	2D	40	ED	B0.	605
17571	C3	F3	43	01	00	14	CD.	731
17578	F5	08	2A	32	40	01	0F.	425
17585	27	AF	ED	12	[illegible]	02	CF.	782
17592	1F	2A	32	40	CD	D8	09.	617
17599	28	23	E5	3E	00	D7	E1.	809
17606	46	23	4E	23	23	E5	ED.	719
17613	43	3E	40	CD	9A	0A	F1.	748
17620	23	E5	CD	BB	02	E5	C1.	1080
17627	51	14	3E	00	28	F5	CD.	653
17634	BD	07	7E	FE	00	28	3C.	884
17641	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	672
17648	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	505
17655	00	06	18	7A	B3	20	FE.	617
17662	1B	18	FE	20	17	E1	[illegible]	633
17669	2A	3E	40	CD	D8	09	46.	668
17676	E3	4E	ED	43	0A	40	ED.	725
17683	43	23	40	CD	3E	05	CF.	646
17690	0C	E1	E5	ED	4B	0C	40.	354
17697	AF	ED	42	30	F3	E1	7E.	1122
17704	FE	76	[illegible]	21	23	7E	7E.	[illegible]
17711	D7	E1	18	23	23	23	23.	911
17718	08	23	23	23	23	78	23.	818
17725	18	E5	CD	7E	23	01	77.	972
17732	0E	CD	19	D0	7E	1E	2C.	534
17739	3A	3A	40	E1	FE	03	[illegible]	702
17746	03	C3	D4	44	E5	2A	0C.	781
17753	40	E6	11	21	00	19	D1.	577
17760	01	D6	02	ED	B0	ED	0E.	686
17767	40	AF	11	E1	00	40	[illegible]	806
17774	22	0E	40	3A	3A	40	3C.	382
17781	3E	3A	40	E1	7E	FE	76.	895
17788	CA	C0	44	C3	04	44	C3.	1132

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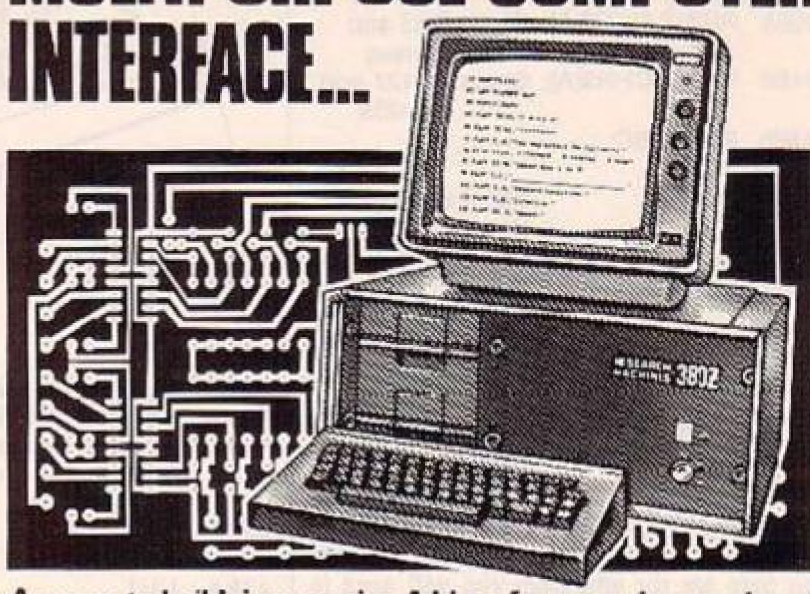
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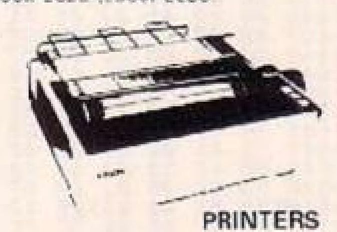
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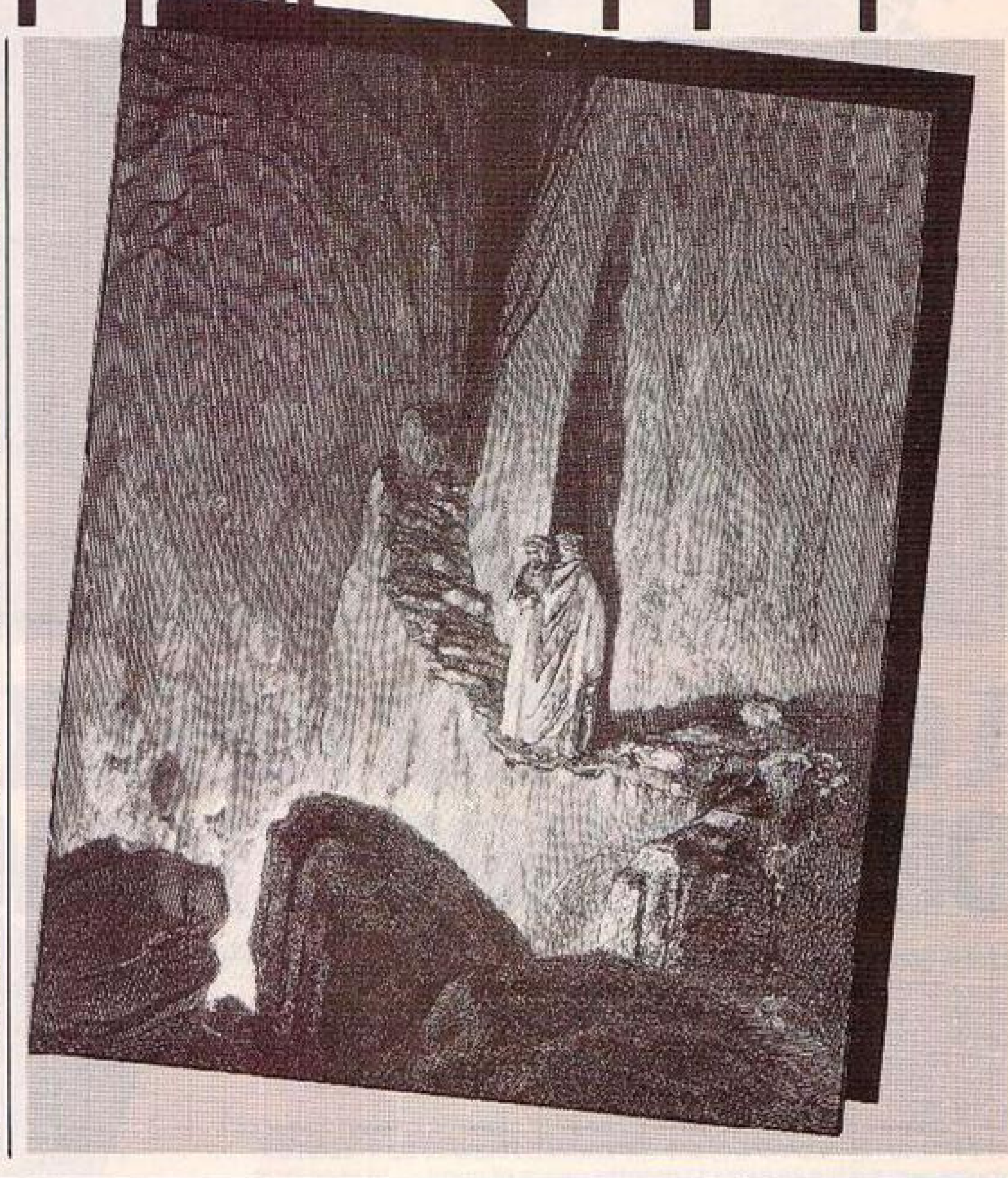
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LABYRINTH

Enter the depths with Paul Hadler and his Vic-20.



THIS PROGRAM WAS inspired by a program I had a game of one dark and chilly winter evening last year. The aim of that game was to make your way through a plan of a maze randomly chosen by the computer in as short a time as possible. Points were awarded for speed and agility around the maze. This led me to start work on a game which would be displayed in three dimensions visually on the screen so as to give the impression of actually walking the corridors of the labyrinth. It would also have extra features to help a hopelessly lost computer games addict reach the exit.

The program itself runs on a Vic-20 with 16K memory expansion and I must say takes a fair old time to load from the faithful cassette unit of the Vic-20.

As with some other programs, there are no fuss and bother items before loading the program with Peeks and Pokes or anything else for that matter. Just simply run the program once loaded into the computer and let it do the work.

Once loaded and run the program will ask for vertical and horizontal dimensions of the maze, the maximum sizes of which are 18 by 18 cells. The computer will then build the maze starting with a random entry point in the south wall. On completion of the maze build the user is then required to state if he or she would like to see a two dimensional view of the maze.

The program then draws up on the screen a

(continued on page 135)

```
10 REM****************
12 REM*              *
20 REM*  LABYRINTH   *
30 REM*              *
40 REM* BY P.HADLER  *
50 REM*              *
60 REM****************
70 REM
80 REM
90 REM
100 POKE36879,8:PRINT"■"
1 0 PRINT"■■■■     $           ■"
1 5 PRINT"      $ LABYRINTH ■"
120 PRINT"      $           ■"
125 FORT=1TO1000:NEXT
130 PRINT"■■          BY"
135 PRINT"■■      PAUL HADLER"
140 FORT=1TO3000:NEXT
200 REM*SIZE OF MAZE*
210 REM
220 INPUT"■VERTICAL LENGTH■■■■■■■";V
230 INPUT"■HORIZ. LENGTH■■■■■■■";H
240 IFV>INT(V)ORV<1ORV>18GOTO250
250 IFH=INT(H)ANDH>0ANDH<19GOTO290
260 PRINT"■■■MAX. MAZE SIZE 19 X 12":FORV=1TO1200:NEXT
280 GOTO220
290 PRINT"■PLEASE WAIT WHILE MAZE":PRINT"IS BUILT."
300 REM**BUILD MAZE**
310 REM
331 V=0:X=0:I=0:XF=0:C=2:RV=0:IX=0:NF=0:EF=0:SF=0:WF=0:D=0:WO=0:A=0:B=0:AQ=0
332 B0=0:P=0:W=0:S=0:E=0:N=0:L=0:F=0:R=0:N0=0:EQ=0:SQ=0:WQ=0:ZC=0:C=0:OM=0
333 Z=0:T=0:L0=0:F0=0:R0=0:M=0:CF=2:J=0:XY=0:ZZ=0
340 DIMP(H,V),Q(H,V),C(H*V,2)
345 P(0,0)=0:FORY=1TOV:P(0,Y)=2:NEXTY
350 FORX=1TOH:P(X,0)=1:FORY=1TOV:P(X,Y)=3:NEXTY,X
380 CL$="           ■■■■■■■■■■■■"
390 PS$="■■"
400 REM*RND ENTRY POINT*
410 REM**IN SOUTH WALL**
420 REM
430 RV=INT(H*RND(8))+1
440 IX=RV:X=IX:Y=1:Q(X,Y)=1:P(X,0)=0
500 REM*FIND ALLOWED DIRECTION FOR NEXT MOVE*
520 REM
530 NF=0:IFY<VTHENIFQ(X,Y+1)=0THENNF=1
540 IFY=VANDXF=0THENNF=1
550 EF=0:IFX<HTHENIFQ(X+1,Y)=0THENEF=1
560 SF=0:IFY>1THENIFQ(X,Y-1)=0THENSF=1
570 WF=0:IFX>1THENIFQ(X-1,Y)=0THENWF=1
600 REM*CHOOSE DIRECTION OF MOTION*
610 REM
620 RV=INT((NF+EF+SF+WF)*RND(1))+1
630 D=8*NF+4*EF+2*SF+WF
640 IFD=0GOTO1520:REM*DEAD END/FIND START OF NEXT BUILD*
650 ONDGOTO1320,1220,700,1120,710,720,730,900,740,750,760,770,780,790
700 ONRVGOTO1220,1320
710 ONRVGOTO1120,1320
720 ONRVGOTO1120,1220
730 ONRVGOTO1120,1220,1320
740 ONRVGOTO920,1320
750 ONRVGOTO920,1220
760 ONRVGOTO920,1220,1320
770 ONRVGOTO920,1120
780 ONRVGOTO920,1120,1320
790 ONRVGOTO920,1120,1220
900 REM**MOVE NORTH**
910 REM
920 IFY=VGOTO1020:REM*MAKE EXIT IN NORTH WALL*
930 Y=Y+1
940 Q(X,Y)=C
950 IFP(X,Y-1)=3THENP(X,Y-1)=2:GOTO1430
960 P(X,Y-1)=0:GOTO1430
1000 REM**MAKE EXIT IN NORTH WALL**
1010 REM
1020 XF=1:WO=X
1030 IFP(X,Y)=3THENP(X,Y)=2:GOTO1520:REM*FIND START OF NEXT BUILD*
1040 P(X,Y)=0:GOTO1520
1100 REM**MOVE EAST**
1110 REM
1120 X=X+1
1130 Q(X,Y)=C
1140 IFP(X-1,Y)=3THENP(X-1,Y)=1:GOTO1430
1150 P(X-1,Y)=0:GOTO1430
1200 REM**MOVE SOUTH**
1210 REM
1220 Y=Y-1
1230 Q(X,Y)=C
1240 P(X,Y)=2
1250 GOTO1430
1300 REM**MOVE WEST**
1310 REM
1320 X=X-1
1330 Q(X,Y)=C
1340 P(X,Y)=1
1400 REM*BUILD COMPLETE*
1410 REM*IF SO MAKE EXIT IF NECESSARY*
```

(listing continued on page 135)

(continued from page 133)
three dimensional representation of the maze of whichever way you are facing to the maze. You then proceed into and around the maze to hopefully search for the way out.

To manouvre yourself around the maze use the following control keys:

L — Left turn; R — Right turn; F — Forward; A — About turn.

If you should find your quest for the exit is not progressing as fast as you would like there is another command which has been incorported into the program for your assistance. This command is called Help and is further subdivided into commands which will tell you certain information about the maze. But, before a description of each command is given a word in your ear. In this command — Help — a truthful account of your position and general status is not always given, so beware, or you would be led up the garden path. Sorry.

The help commands are H followed by:

X — This may give you your current position in the maze.

D — This gives you a distance in moves to the exit.

S — For a suggested next move — very dodgy.

At this point I would like to point out that a wrong move — or suggested wrong move — may cause you to fall out of the maze if lurking around the start position in the maze; so be careful. And finally:

? — For a plan of the maze.

To get out of the Help routine and back to the maze display type I.

Lines

100-290	Begin the maze build.
400-440	Random entry point in south wall.
500-570	Find allowed direction for next move.
600-790	Choose direction of motion.
900-960	Move north.
1000-1040	Make exit in north wall.
1100-1150	Move east.
1200-1250	Move south.
1300-1340	Move west.
1400-1470	If build complete make exit if necessary. Put player at start position.
1500-1560	Begin new maze build.
1600-2190	Code complete information about each cell in array P(X,Y).
2200-2290	Determine direction through maze.
2600-2820	Display depth 1.
3000-3220	Display depth 2.
3400-3620	Display depth 3.
3800-4020	Display depth 4.
5000-6690	Accept commands and execute end games.
6800-6870	Another game.
6900-6960	Index to next cell.
7000-7280	Calculate L, R and F.
7300-7460	Subroutines.
7500-7610	Determine direction of next move.

(listing continued from page 133)



```
1420 REM
1430 IFC<H*VTHENC=C+1:GOTO530:REM*NEXT MOVE*
1440 IFXF=1GOTO1450:REM*EXIT MADE*
1450 X=INT(H*RND(1))+1:Y=Y:P(X,Y)=P(X,Y)-1:WO=X
1460 X=1X:Y=0:Z=1:REM*PUT PLAYER IN START POSITION*
1470 GOTO1620
1500 REM*FIND START OF NEXT BUILD*
1510 REM
1520 IFX<HTHENX=X+1:GOTO1550
1530 IFY<VTHENY=Y+1:X=1:GOTO1550
1540 X=1:Y=1
1550 IFQ(X,Y)=0GOTO 1520
1560 GOTO530
1600 REM* IS PLAN REQUIRED*
1610 REM
1620 PRINT"JTHE MAZE HAS NOW  BEEN":PRINT"BUILT, WOULD  YOU LIKE":PRINT"TO SEE A
 PLAN"
1630 PRINT"XX  Y=YES AND N=NO"
1660 GETA$
1670 IFA$="Y"THENGOTO1695
1680 IFA$="N"THENGOTO1900
1690 GOTO1660
1695 REM*PRINT PLAN OF MAZE*
1697 REM
1700 PRINT"JXX";
1710 FORJ=VTO0STEP-1
1730 FORI=0TOH
1735 P=P(I,J)-4*INT(P(I,J)/4)
1740 IFP=0THENPRINT" ";
1750 IFP=1THENPRINT"";
1760 IFP=2THENPRINT" F;
1770 IFP=3THENPRINT""T;
1780 IFI=HTHENPRINT
1790 NEXTI,J
1800 XY=4096-22*(2+V-Y)+X
1802 IFZ=1THENZZ=158
1804 IFZ=2THENZZ=190
1806 IFZ=3THENZZ=150
1808 IFZ=4THENZZ=188
1810 P=PEEK(XY)
1820 FORI=1TO10
1830 POKEXY,ZZ:FORJ=1TO100:NEXT:POKEXY,P:FORJ=1TO100:NEXT
1840 NEXT
1850 IFA$="P"GOTO2400
1860 POKEXY,30
1870 PRINT"XPLEASE WAIT"
1900 REM**PRINT INSTRUCTIONS**
1910 REM
2100 REM*CODE COMPLETE INFORMATION*
2110 REM*ABOUT EACH CELL*
2120 REM*IN ARRAY P(X,Y)*
2130 REM
2140 FORI=1TOH:FORJ=1TOV
2160 IFINT(P(I-1,J)/4-INT(P(I-1,J)/4)+.5)=1THENP(I,J)=P(I,J)+8
2180 IFP(I,J-1)/2-INT(P(I,J-1)/2)=.5THENP(I,J)=P(I,J)+4
2190 NEXTJ,I
2200 REM**DETERMINE OPTIMAL ROUTE**
2210 REM**THROUGH MAZE**
2220 REM
2230 C(0,1)=WO:C(0,2)=V+1:I=1:A=WO:B=V:GOTO2270
2240 I=I+1
2250 GOSUB7520:REM*OPTIMAL DIRECTION*
2260 GOSUB6920:REM*INDEX TO NEXT CELL*
2270 C(I,1)=A:C(I,2)=B
2280 IFQ(A,B)>1GOTO2240
2290 CM=I
2400 REM**PRINT PERSPECTIVE VIEW**
2410 REM
2420 PRINT"J";
2430 A=X:B=Y
2440 FORT=1TO4
2450 GOSUB7020:REM*EVALUATE L,F & R*
2460 IFF=-2GOTO2510
2470 ONTGOSUB2620,3020,3420,3820
2480 IFF=1GOTO2510
2490 ZC=Z:GOSUB6920:REM*INDEX TO NEXT CELL*
2500 NEXT
2510 GOTO5000:REM*ACCEPT INSTRUCTIONS*
2600 REM**DISPLAY DEPTH 1**
2610 REM
2620 IFL=2OR(L=-1ANDZ=3)GOTO2640
2630 FORI=1TO17:POKE4163+22*I,103:NEXT
2640 IFR=2OR(R=-1ANDZ=3)GOTO2660
2650 FORI=1TO17:POKE4181+22*I,101:NEXT
2660 ON(4-L)GOTO2720,2680,2670,2700,2710
2670 POKE4140,77:POKE4163,77
2680 POKE4559,78:POKE4580,78
2690 GOTO2720
2700 POKE4162,100:POKE4163,100
2710 POKE4558,99:POKE4559,99
2720 ON(4-R)GOTO2780,2740,2730,2760,2770
2730 POKE4181,78:POKE4158,78
2740 POKE4577,77:POKE4600,77
```

(listing continued on next page)

(listing continued from previous page)

```
2750 GOTO2760
2760 POKE4181,100:POKE4182,100
2770 POKE4577,99:POKE4578,99
2780 IFF<1ORF>2GOTO2820
2790 IFF=2GOTO2810
2800 FORI=1TO17:POKE4163+I,100:NEXT
2810 FORI=1TO17:POKE4559+I,99:NEXT
2820 RETURN
3000 REM**DISPLAY DEPTH 2**
3010 REM
3020 IFL=2OR(L=-1ANDP=3)GOTO3040
3030 FORI=1TO9:POKE4255+22*I,103:NEXT
3040 IFR=2OR(R=-1ANDQ=3)GOTO3060
3050 FORI=1TO9:POKE4265+22*I,101:NEXT
3060 ON(4-L)GOTO3120,3080,3070,3100,3110
3070 POKE4186,77:POKE4209,77:POKE4232,77:POKE4255,77
3080 POKE4538,78:POKE4517,78:POKE4496,78:POKE4475,78
3090 GOTO3120
3100 POKE4252,100:POKE4253,100:POKE4254,100:POKE4255,100
3110 POKE4472,99:POKE4473,99:POKE4474,99:POKE4475,99
3120 ON(4-R)GOTO3180,3140,3130,3160,3170
3130 POKE4265,78:POKE4244,78:POKE4223,78:POKE4202,78
3140 POKE4485,77:POKE4508,77:POKE4531,77:POKE4554,77
3150 GOTO3180
3160 POKE4265,100:POKE4266,100:POKE4267,100:POKE4268,100
3170 POKE4485,99:POKE4486,99:POKE4487,99:POKE4488,99
3180 IFF<1ORF>2GOTO3220
3190 IFF=2GOTO3210
3200 FORI=1TO9:POKE4255+I,103:NEXT
3210 FORI=1TO9:POKE4475+I,99:NEXT
3220 RETURN
3400 REM**DISPLAY DEPTH 3**
3410 REM
3420 IFL=2OR(L=-1ANDP=3)GOTO3440
3430 FORI=1TO5:POKE4301+22*I,103:NEXT
3440 IFR=2OR(R=-1ANDQ=3)GOTO3460
3450 FORI=1TO5:POKE4307+22*I,101:NEXT
3460 ON(4-L)GOTO3520,3480,3470,3500,3510
3470 POKE4278,77:POKE4301,77
3480 POKE4454,78:POKE4433,78
3490 GOTO3520
3500 POKE4300,100:POKE4301,100
3510 POKE4432,99:POKE4433,99
3520 ON(4-R)GOTO3580,3540,3530,3560,3570
3530 POKE4286,78:POKE4307,78
3540 POKE4439,77:POKE4462,77
3550 GOTO3580
3560 POKE4307,100:POKE4308,100
3570 POKE4439,99:POKE4440,99
3580 IFF<1ORF>2GOTO3620
3590 IFF=2GOTO3610
3600 FORI=1TO5:POKE4301+I,100:NEXT
3610 FORI=1TO5:POKE4433+I,99:NEXT
3620 RETURN
3800 REM**DISPLAY DEPTH 4**
3810 REM
3820 IFL=2OR(L=-1ANDP=3)GOTO3840
3830 POKE4346,103:POKE4368,103:POKE4390,103
3840 IFR=2OR(R=-1ANDQ=3)GOTO3860
3850 POKE4350,101:POKE4372,101:POKE4394,101
3860 ON(4-L)GOTO3920,3880,3870,3900,3910
3870 POKE4324,77
3880 POKE4412,78
3890 GOTO3920
3900 POKE4324,100
3910 POKE4412,99
3920 ON(4-R)GOTO3980,3940,3930,3960,3970
3930 POKE4328,78
3940 POKE4416,77
3950 GOTO3980
3960 POKE4328,100
3970 POKE4416,99
3980 IFF<1ORF>2GOTO4020
3990 IFF=2GOTO4010
4000 POKE4325,100:POKE4326,100:POKE4327,100
4010 POKE4413,99:POKE4414,99:POKE4415,99
4020 RETURN
5000 REM**ACCEPT INSTRUCTIONS**
5010 REM
5080 PRINT"COMMAND?          ■■■■■■■■";
5090 PRINT"■";:FORI=1TO200:NEXT:PRINT"■ ■";:FORI=1TO200:NEXT
5100 GETA$
5110 IFA$="H"GOTO5220
5120 IFA$="L"GOTO6220
5130 IFA$="R"GOTO6320
5140 IFA$="A"GOTO6420
5150 IFA$="F"GOTO6550
5160 GOTO5090
5200 REM**HELP ROUTINE**
5210 REM
5220 PRINT"HELP":FORI=1TO500:NEXT
5230 PRINT"HELP■■":PRINT" Z■ FOR DIRECTION":PRINTSPC(3);"FACED"
5240 PRINT" X■ FOR CURRENT":PRINTSPC(3);"POSITION"
5250 PRINT" D■ FOR DISTANCE":PRINTSPC(3);"TO EXIT"
5260 PRINT" S■ FOR SUGGESTED":PRINTSPC(3);"NEXT INSTRUCTION"
5270 PRINT" E■ TO EXECUTE":PRINTSPC(3);"SUGGESTION"
5275 PRINT" P■ FOR MAZE PLAN"
5280 PRINT"■ I■ TO END HELP":PRINT
5310 GETA$
5320 IFA$="Z"GOTO5420
5330 IFA$="X"GOTO5520
5340 IFA$="D"GOTO5615
5350 IFA$="S"GOTO5720
5360 IFA$="E"GOTO5820
5365 IFA$="P"GOTO1700
5370 IFA$="I"GOTO2420:REM*END HELP/ACCEPT FURTHER INSTRUCTIONS*
5380 GOTO5310
5400 REM*DIRECTION FACED*
5410 REM
5420 PRINT"YOU ARE FACING■ ";
5425 Z=1
5430 IFZ=1THENPRINT"NORTH"
5440 IFZ=2THENPRINT"EAST"
5450 IFZ=3THENPRINT"SOUTH"
5460 IFZ=4THENPRINT"WEST"
5465 FORI=1TO2000:NEXT
5470 GOTO5230
5520 PRINT"POSITION■ ";X;",";Y:FORI=1TO2000:NEXT
5530 GOTO5230
5600 REM**DETERMINE DIST. TO EXIT**
5610 REM
5615 PRINT"THINKING"
5620 A=X:B=Y:M=0
5630 GOSUB6020:REM*FIND OPTIMAL DIRECTION OF NEXT MOVE*
5635 IFCF=1THENM=M+J:GOTO5670
5640 GOSUB6920:REM*INDEX TO NEXT CELL*
5650 M=M+1:IFM<20GOTO5660
5655 PRINT"TOO FAR TO CALCULTE":FORI=1TO2000:NEXT:GOTO5230
5660 IFB<V+1GOTO5630
5670 PRINT"":PRINTM;"■ UNITS TO EXIT":FORI=1TO2000:NEXT
5690 GOTO5230
5700 REM*DETERMINE BEST NEXT INSTRUCTION*
5710 REM
5720 A=X:B=Y:GOSUB6020:REM*FIND OPTIMAL DIRECTION OF NEXT MOVE*
5730 PRINT"SUGGESTED MOVE■":
5740 IFZ=Z0THENPRINT" FORWARD■"
5750 IFZ-Z0=1ORZ-Z0=-3THENPRINT" TURN LEFT■"
5760 IFZ-Z0=3ORZ-Z0=-1THENPRINT" TURN RIGHT■"
5770 IFABS(Z-Z0)=2THENPRINT" ABOUT TURN■"
5780 FORI=1TO2000:NEXT:GOTO5230
5800 REM**EXECUTE OPTIMAL INSTRUCTION**
5810 REM
5820 A=X:B=Y:GOSUB6020:REM*FIND OPTIMAL DIRECTION OF NEXT MOVE*
5830 IFZ=Z0THENA$="F"
5840 IFZ-Z0=1ORZ-Z0=-3THENA$="L"
5850 IFZ-Z0=3ORZ-Z0=-1THENA$="R"
5860 IFABS(Z-Z0)=2THENA$="A"
5870 PRINT"":GOTO5110
6000 REM*FIND OPTIMAL DIRECTION OF MOVE*
6010 REM
6020 IFB>0GOTO6070
6030 IFA=IXTHENZ0=1
6040 IFA<IXTHENZ0=2
6050 IFA>IXTHENZ0=4
6060 RETURN
6070 CF=0:FORI=1TOOM
6075 RETURN
6080 IFC(I,1)<>AORC(I,2)<>BGOTO6092
6082 IFC(I-1,2)=B+1THENZ0=1
6084 IFC(I-1,2)=A+1THENZ0=2
6086 IFC(I-1,2)=B-1THENZ0=3
6088 IFC(I-1,1)=A-1THENZ0=4
6090 J=I:I=OM:CF=1
6092 NEXT
6094 IFCF=0THENGOSUB7520
6095 RETURN
6200 REM**TURN LEFT**
6210 REM
6220 PRINT"LEFT■":FORI=1TO400:NEXT
6230 Z=Z-1:IFZ=0THENZ=4
6240 GOTO2420:REM*PRINT PERSPECTIVE VIEW*
6300 REM**TURN RIGHT**
6310 REM
6320 PRINT"RIGHT■":FORI=1TO400:NEXT
6330 Z=Z+1:IFZ=5THENZ=1
6340 GOTO2420:REM*PRINT PERSPECTIVE VIEW*
6400 REM**ABOUT TURN**
6410 REM
6420 PRINT"ABOUT TURN■":FORI=1TO400:NEXT
6430 Z=Z+2-4*SGN(1-SGN(Z-3))
6440 GOTO2420:REM*PRINT PERSPECTIVE VIEW*
6500 REM**MOVE FORWARD**
6510 REM**CHECK IF GAME FINISHED**
6530 REM**OR WALKING INTO WALL**
6540 REM
6550 PRINT"FORWARD■":FORI=1TO400:NEXT
6560 A=X:B=Y:GOSUB7020:REM*EVALUATE L,F & R*
6570 IFF<>1GOTO6630
6580 PRINT"STRAIGHT INTO A WALL!"
6590 FORI=1TO100:POKE36865,INT(RND(1)*3+38):NEXT:POKE36865,38
6600 PRINT"■"
6610 GOTO5080:REM*NEW INSTRUCTION*
6630 Z0=Z:GOSUB6920:REM*INDEX TO NEXT CELL*
6640 X=A:Y=B
6650 IFY>=0ANDY<=VANDX>0ANDX<=HGOTO2400:REM*PRINT PERSPECTIVE VIEW*
6655 IFY>VGOTO6690
6660 PRINT"■■■■■■■■■■■■■■■■■■■■■■■■AAAAAH!!!"
6665 FORI=38TO25STEP-1:POKE36865,I:FORJ=1TO12:NEXT:NEXT:PRINT"":POKE36865,38
6670 PRINT"■■■■■■■■■■YOU'VE FALLEN OVER THE":PRINT"EDGE OF THE WORLD!!"
6680 FORI=1TO5000:NEXT:GOTO6815
6690 PRINT"■■■■■■■■■■■■■■■■WAY-OUT!":FORI=1TO2000:NEXT
6800 REM**ANOTHER GAME**
6810 REM
6815 PRINT"TYPE:-"
6820 PRINT"■ 1■ TO TRY THE SAME":PRINT"   MAZE AGAIN"
6825 PRINT"■ 2■ TO TRY A NEW MAZE"
6830 PRINT"■ 3■ IF YOU DON'T WANT":PRINT"   ANOTHER GAME"
6835 PRINT"■■■WHICH OPTION PLEASE?"
6840 GETA$
6850 IFA$="1"THENX=IX:Y=0:Z=1:GOTO2420
6855 IFA$="2"THENCLR:GOTO220
6860 IFA$="3"GOTO6870
6865 GOTO6840
6870 PRINT"":END
6900 REM**INDEX TO NEXT CELL**
6910 REM
6920 IFZ0=1THENB=B+1
6930 IFZ0=2THENA=A+1
6940 IFZ0=3THENB=B-1
6950 IFZ0=4THENA=A-1
6960 RETURN
7000 REM**EVALUATE L,F & R**
7010 REM
7020 IFB<1GOTO7051:REM*OUTSIDE MAZE TO SOUTH*
7030 IFB>VTHENF=-2:RETURN:REM*OUTSIDE MAZE TO NORTH*
7040 A0=A:B0=B:GOSUB7320
7050 GOTO7100
7051 IFZ>1GOTO7060
7052 F=1:IFA=IXTHENF=0
7053 IFA=1THENL=2
7054 IFA=IX+1THENL=3
7055 IFA>1ANDA<>IX+1THENL=1
7056 IFA=HTHENR=2
7057 IFA=IX-1THENR=3
7058 IFA<HANDA<>IX-1THENR=1
7059 RETURN
7060 W=-1:IFA<2THENW=-2:IFA=1THENW=2
7070 S=-2:IFB=0THENS=2
7080 E=-1:IFA>HTHENE=-2:IFA=HTHENE=2
7090 N=1:IFA=IXTHENN=0
7100 GOSUB7420
7110 L=L0:F=F0:R=R0
7120 IFL<>0GOTO7200
7130 IFZ=1THENA0=A-1
7140 IFZ=2THENB0=B+1
7150 IFZ=3THENA0=A+1
7160 IFZ=4THENB0=B-1
7170 GOSUB7320
7180 GOSUB7420
7190 IFF0<>1THENL=3
7200 IFR<>0THENRETURN
7210 IFZ=1THENA0=A+1
7220 IFZ=2THENB0=B-1
7230 IFZ=3THENA0=A-1
7240 IFZ=4THENB0=B+1
7250 GOSUB7320
7260 GOSUB7420
7270 IFF0<>1THENR=3
7280 RETURN
7300 REM**SUBROUTINE**
7310 REM
7320 P=P(A0,B0):N=SGN(1+SGN(P-8))
7330 P=P-8*N:S=SGN(1+SGN(P-4))
7340 P=P-4*S:E=SGN(1+SGN(P-2))
7350 P=P-2*E:W=P
7360 IFB0=1ANDA0=IXTHENS=2
7370 IFB0=VANDA0=WTHENN=3
7380 RETURN
7400 REM**SUBROUTINE**
7410 REM
7420 IFZ=1THENL0=W:F0=N:R0=E
7430 IFZ=2THENL0=N:F0=E:R0=S
7440 IFZ=3THENL0=E:F0=S:R0=W
7450 IFZ=4THENL0=S:F0=W:R0=N
7460 RETURN
7500 REM**DETERMINE OPTIMAL DIRECTION OF NEXT MOVE**
7510 REM
7520 A0=A:B0=B:GOSUB7320:REM*EVALUATE N,E,S & W*
7530 NC=H*V+1:IFN=0THENN0=C(A,B+1)
7540 EC=H*V+1:IFE=0THENE0=C(A+1,B)
7550 SC=H*V+1:IFS=0THENS0=C(A,B-1)
7560 WC=H*V+1:IFW=0THENW0=C(A-1,B)
7570 Z0=1:O=N0
7580 IFE0<OTHENZ0=2:O=E0
7590 IFS0<OTHENZ0=3:O=S0
7600 IFW0<OTHENZ0=4:Z=W0
7610 RETURN
```

■

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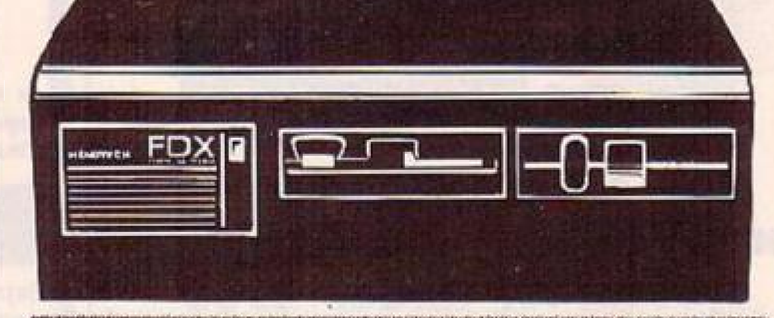
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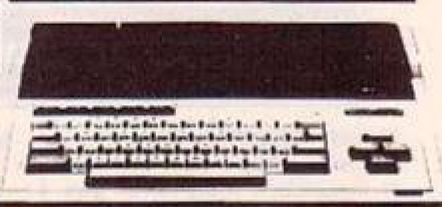


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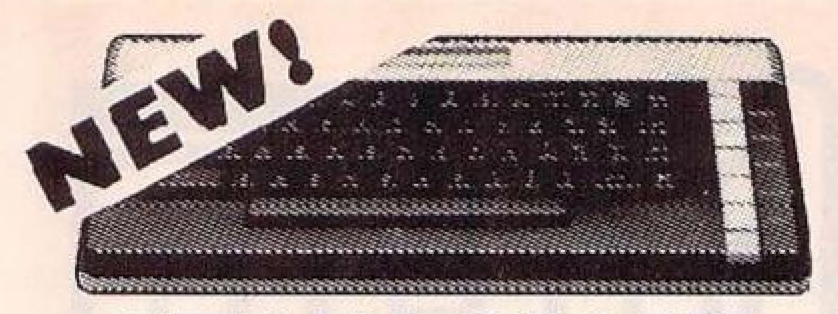
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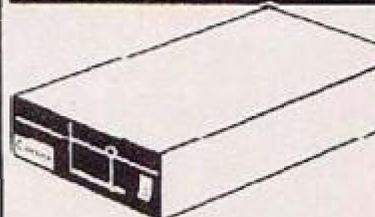


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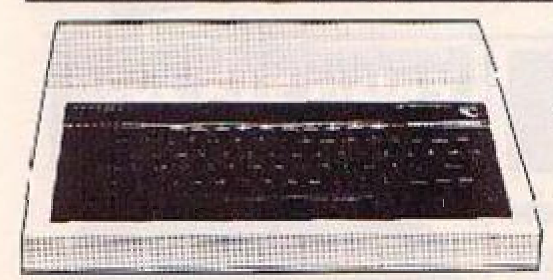
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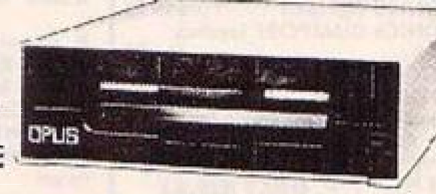
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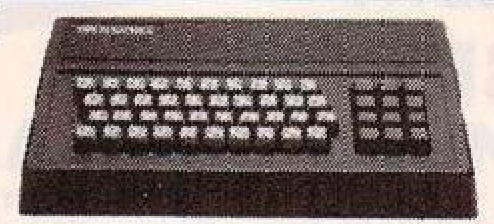
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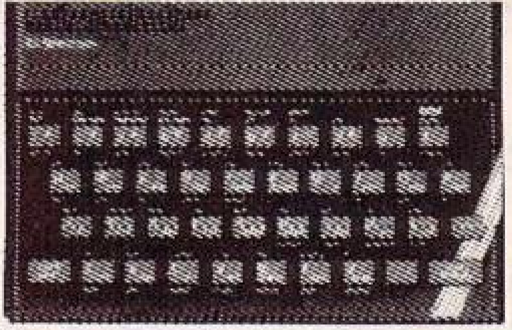
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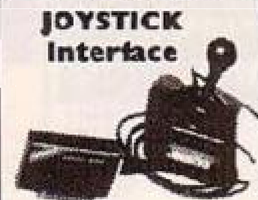
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N14 Logic Sales, 19 Broadway, The Bourne, Southgate. Tel: (01) 882 4942
N20 Castlehurst Ltd 1291 High Rd Tel: (01) 446 2280
NW4 Da Vinci Computer Store 112 Brent St., Hendon Tel: (01) 202 2272
SE1 Vic Odden's 6 London Bridge Walk. Tel: (01) 403 1988
SE9 Square-Deal, 373-375 Footscray Rd., New Eltham. Tel: (01) 859 1516
SE11 Gatwick Computers, 328 Kennington Park Rd. Tel: (01) 587 0336 Adjacent to Oval Tube
SE15 Castlehurst Ltd., 152 Rye Lane, Peckham. Tel: (01) 639 2205
SE25 Ellis Marketing, 79 High St., South Norwood. Tel: (01) 653 4224
SW16 Dufer Micro Shop, 310 Streatham High Rd. Tel: (01) 769 2887
SW19 Ernmom, 31 High St, Wimbledon. Tel: (01) 947 7678
W1 Computers of Wigmore St., 87 Wigmore St. Tel: (01) 486 0373
W1 GK Photo & Computers, 92-94 Wardour St. Tel: (01) 437 0182
W1 Sonic Foto & Micro Centre, 256 Tottenham Court Rd. Tel: (01) 580 5826
W2 Devron, 4 Edgware Rd. Tel: (01) 724 2373
W3 Thames Computing 163 High St. Acton Tel: (01) 992 6888
W7 TK Electronics, 11/13 Boston Rd., Hanwell. Tel: (01) 579 2842
WC2 City Camera Exchange, 115 Kingsway Tel: (01) 405 0446

MANCHESTER GREATER

BOLTON Wilding Ltd., 23 Deansgate Tel: (0204)33512
MANCHESTER Johax Ltd., 8 Exchange St. St. Ann's Square. Tel (061) 832 6167
OLDHAM Home & Business Computers Ltd, 54 Yorkshire St. Tel: (061) 6331608
ROCHDALE Home & Business Computers, 75 Yorkshire St. Tel: (0706) 344654
SWINTON Mr Micro Ltd., 69 Partington Lane. Tel: (061) 728 2282 Late Night Friday
WIGAN Wilding Ltd., 11 Mesnes St. Tel: (0942) 44382

MERSEYSIDE

BIRKENHEAD Fairs Cameras & Hi-Fi, Dacre Hill, Rock Ferry. Tel: (051) 645 5000
HESWALL Thornguard Computer Systems, 46 Pensby Rd. Tel: (051) 342 7516
HUYTON Ian Houghton 5 Huyton Hey Rd. Tel: (051) 489 5785
LIVERPOOL Beaver Radio, 20-22 Whitechapel. Tel: (051) 709 9898
LIVERPOOL (Aintree) Hargreaves, 31-37 Warbreck Moor. Tel: (051) 525 1782
SOUTHPORT Central Computers, 575 Lord St. Tel: (0704) 31881
ST HELENS Studio 55, 55 Ormskirk St. Tel: (0744) 39496

MIDDLESEX

EDGWARE GK Photographic & Computers 106 High St. Tel: (01) 951 1003
HARROW Camera Arts, (Micro Computer Division) 24 St Annes Rd. Tel: (01) 427 5469
HAYES Chipstos, 1000 Uxbridge Rd. Tel: (01) 573 2511
STAINES Spelthorne Microsystems Ltd. 2 Kingston Rd. Tel: (0784) 55659/55554
TEDDINGTON Andrews, Broad St. Tel: (01) 977 4716
UXBRIDGE J & L Computers, 7 Windsor St. Tel: (0895) 51815

NORFOLK

FAKENHAM Fastview, 12 Norwich Rd. Tel: (0328) 51319
NORWICH Sound Marketing, 52 St. Benedicts St. Tel: (0603) 667725
THETFORD C B & Micros, 21 Guildhall St. Tel: (0842) 61645

NORTHAMPTONSHIRE

NORTHAMPTON Dormans, 22 Princes Walk Grosvenor Centre. Tel: (0604) 37031

NOTTINGHAMSHIRE

NOTTINGHAM Cameo Computer, 8/9/10 Trinity Walk. Tel: (0602) 742912
NOTTINGHAM Jacobs Computers, 13 Middlegate Newark. Tel: (0636) 72594 (Just Opening)
WORKSOP Computergraphix, 132 Bridge St. Tel: (0909) 472248

NORTHERN IRELAND

BELFAST Arthur Hobson Ltd., 37 Great Victoria St. Tel: (0232) 246336
CO ARMAGH Pedlows, 16 Market St., Portadown Craigavon. Tel: (0762) 332265
LONDONDERRY Foyle Computer Systems, 3 Bishop St. Tel: (0504) 268337
NEWRY Newry Computer Centre 34 Monaghan St. Tel: (0693) 66545

OXFORDSHIRE

ABINGDON Ivor Fields Computers, 21 Stert St. Tel: (0235) 21207
BANBURY Computer Plus, 2 Church Lane. Tel: (0295) 55890
HENLEY-ON-THAMES Family Computers Ltd., 40A Bell St. Tel: (0491) 575744
OXFORD Ivor Fields, 7 St. Ebbes St. Tel: (0865) 247082

SCOTLAND

ABERDEEN North East Computers, 1-3 Ellis St., Peterhead. Tel: (0779) 79900
AYR Vennals, 6A New Bridge St. Tel: (0292) 264124
DUMFRIES Vennals, 71 English St. Tel: (0387) 54547
EDINBURGH The Silicon Centre, 6-7 Antigua St. Tel: (031) 557 4546
GLASGOW Victor Morris Ltd., 340 Argyle St. Tel: (041) 221 8958
HAMILTON Tom Dickson Computers, 8-12 Cadzow St. Tel: (0698) 283193
KILMARNOCK Vennals, 49 Foregate. Tel: (0563) 32175
KIRKCALDY Kirkaldy Photographic Services, 254E High St., Fife. Tel: (0592) 204734
STIRLING R Kilpatrick, 58 Port St. Tel: (0786) 5532

SHROPSHIRE

SHREWSBURY Computerama, 13 Castlegate. Tel: TBA
TELFORD Computer Village, 4 Hazeldine House Telford Town Centre. Tel: (0952) 504666

SOMERSET

TAUNTON Grays, 1 St James St. Tel: (0823) 72986

STAFFORDSHIRE

STAFFORD Computerama, 59 Forgate St. Tel: (0785) 41899
STOKE-ON-TRENT Computerama, 11 Mkt Square Arcade Hanley. (0782) 268620
STOKE-ON-TRENT The Microchip, 57 Station Rd. Biddulph Tel: (0782) 511559

SUFFOLK

BURY ST EDMUNDS Bury Computer Centre, 11 Guildhall St. Tel: (0284) 705772
IPSWICH Brainwave, 24 Crown St. Tel: (0473) 50965
LOWESTOFT John Wells 44 London Rd North. Tel: (0502) 3742

SURREY

CAMBERLEY Camera Arts (Micro Comput Division), 36 High St. Tel: (0276) 65848
CHERTSEY Chertsey Computer Centre, Windsor St. Tel: (09328) 64563
CROYDON Classic Cameras 16 St Georg Walk. Tel: (01) 686 2012
EPSOM The Micro Workshop, 12 Statio Approach Tel: (03727) 21533
HASLEMERE Haslemere Computers, 25 Junction Pl. (Adj. Rex Cinema) Tel: (0428) 54428
NEW MALDEN Surrey Micro Systems 3 High St. Tel: (01) 942 0478
RICHMOND Crest Computer Services, 8 H St. Tel: (01) 940 8635
WALLINGTON Surrey Micro Systems Ltd 53 Woodcote Rd. Tel: (01) 647 5636
WOKING Harpers, 71-73 Commercial Wa Tel: (04862) 61061

SUSSEX

BEXHILL-ON-SEA Computerware, 22 St Leonards Rd. Tel: (0424) 223340
CRAWLEY Gatwick Computer Services, 6 Boulevard. Tel: (0293) 37842
LITTLEHAMPTON Allan Chase Ltd, 39 Hig St. Tel: (09064) 5574

WALES

ABERDARE Inkey Computer Services Ltd 70 Mill St. The Square Trecynon. Tel: (0685) 881828
ABERYSTWYTH AberData at Galloways 2 Pier St. Tel: (0970) 615522
CARDIFF Randall Cox, 18-22 High S Arcade. Tel: (0222) 31960
LLANDUDNO (Gwynedd) Computer Plu Discount, 15 Clonmel St. Tel: (0492) 7994
NEWPORT (Gwent) Randall Cox, 118 Commercial St. Tel: (0633) 67378
PEMBROKE Randall Cox, 19 Main St. Tel (064) 682876
WREXHAM T E Roberts 26 King St. Tel (0978) 364404/364527

WARWICKSHIRE

LEAMINGTON SPA IC Computers, 4 Russell St. Tel: (0926) 36244
RUGBY The Rugby Micro Centre, 9-1 Regent St. Tel: (0788) 70522

WEST MIDLANDS

BIRMINGHAM Sherwoods, Gt Western Arcade. Tel. (021) 236 7211
COVENTRY Greens, 22 Market Way. Tel: (0203) 28342
DUDLEY Central Computers, 35 Church Hi Precinct. Tel: (0384) 238169
WEST BROMWICH Bell & Jones 39 Queen Square. Tel: (021) 553 0820

WILTSHIRE

SALISBURY Whymark Computer Centre, 2 Milford St. Tel: (0722) 26688

WORCESTER

KIDDERMINSTER Central Computers, 20-21 Blackwell St. Tel: (0562) 746941
WORCESTER David Waring Ltd., 1 Marmio House High St. Tel (0905) 27551

YORKSHIRE

BRADFORD Erricks, Fotosonic House Rawson Square. Tel: (0274) 309266
DEWSBURY Home & Business Computers 59 Daisy Hill. Tel: (0924) 455300
DONCASTER The Soft Centre 6 Queensgate Waterdale Centre Tel: (0302) 20088
HUDDERSFIELD Richards (Formerly Lauries) 12 Queen St. Tel: (0484) 25334
HULL Computer Centre 26 Anlaby Rd. Tel (0482) 23297
LEEDS Bass & Bligh, 4 Lower Briggate. Tel: (0532) 454451
SKIPTON Look & See 45 Belmont Bridge Tel: (0756) 60078
YORK York Computer Centre 7 Stonegate Arcade. Tel: (0904) 641862

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SPRITES

Gary Priest presents a sprite routine for the Dragon.

AS MOST PEOPLE know the Dragon 32 does not have the ability to mix text and high resolution graphics or control sprites.

A Basic program that uses moving high resolution graphics is usually very slow, jerky, and wastes a lot of memory by having to keep checking for collisions etc. The main advantage of sprites are that once they are defined they can be forgotten about and they will continue to move until they come to the edge of the screen. This means that the characters move faster and smoother around the high resolution screen.

My sprite program can handle up to 30 sprites although if you use all 30 sprites at once they will move extremely slowly. In spite of this, they will still move faster than if you used the Dragon's Get and Put commands.

Each sprite has its own x and y co-ordinates and places in memory to store information such as the direction of the sprite.

The machine code, sprite and attributes and graphics data occupy about 4.5K at the top of memory.

(continued on page 147)

Listing 1.

```
10 REM ***************************
20 REM **EXTENDED SPRITE BASIC**
30 REM **BY GARY PRIEST (C)1983*
40 REM ****FOR THE DRAGON 32****
50 REM ***************************
60 REM listing one
70 REM INITIALISE
80 DATA8E,75,36.A6,80,BD,80,CC,81,00,26,F7,8E,7D,63,BF
,01,26,10,8E,81,CA,A6,A0,A7,E0,10,8C,82,2C,23,F6,86,A1
,A7,E0,10,8E,82.30,A6,A0,A7,E0
90 DATA10,8C,82.93,23,F6,8E,7D,E7,BF,01,28,10,8E,6E,69
,10,AF,88,36,8E.74,BE,BF,01,52,8E,74,93,BF,01,95,86,7E
,B7,01,91,B7,01,94,39
100 REM WHICH COMMAND
110 DATA8E,74,B9,5F,10,9E,A6,A6,A4,A1,84,26,20,A6,80,8
1,80,24.06,A1,A0,25,16,20,F4,84,7F,A1,A0,26,0C,10,9F,A
6,58,8E.75,0F,3A,AE,E4,6E,84,30,1F,A6,80,81,80,25,FA,5
C,C1,13,25,CC,7E,88,8D
120 REM MOVE SPRITES
130 DATA86,01,B7,7E,6F,C6,01,B7,7E,6F,3D,C3,7E,71,1F,0
1,E6,80,B7,7F,65,BF,7F,66,C1,00,26,0A,B6,7E,6F,4C,B1,7
5,35,25,E0,39,C1,01,27,1A,C1,02,10,27,00,CA,C1,03,27,6
0,C1,04,10,27,00,8D,B6,7E,6F,4C,B1,75,35,25,C2,39
140 REM UP
150 DATAB6,7E,6F,C6,02,3D,C3,7E,95,1F,01,BF,7F,68,A6,8
0,E6,84,BD,6F,D3,C1,00,27,18,5A,BE,7F,68,A7,80,E7,84,B
D,70,2D.BD,70,00,B6,7E,6F,4C,B1,75,35,25,91,39,BD,70,2
D,3D,70,00,B6,7E,6F,C6,01,3D,C3,7E,71,1F,01,6F
160 DATA84.B6,7E.6F,4C,B1,75,35,10.25.FF.72.39
170 REM DOWN
180 DATAB6,7E,6F,C6,C2,3D,C3,7E,95,1F,01,BF,7F,68,A6,8
0,E6,84.BD,6F,D3,C1,16,27,C8,5C,BE,7F,68,A7,80,E7,84,B
D,70,2D.BD,70,00,B6,7E,6F,4C,B1,75,35,10,25,FF,3F,39
190 REM LEFT
200 DATAB6,7E,6F,C6,C2,3D,C3,7E,95,1F,01,BF,7F,68,A6,8
0,E6,84.BD,6F,D3,81,00,27,95,4A,BE,7F,68,A7,80,E7,84,B
D,70,2D.BD,70,00,B6,7E,6F,4C,B1,75,35,10,25,FF,0C,39
210 REM RIGHT
220 DATAD6,7E,6F,C6,C2,3D,C3,7E,75,1F,01,DF,7F,60,A6,0
0,E6,84.BD,6F,D3,81,1E,10,27,FF,60,4C,BE,7F,68,A7,80,E
7,84,BD,70,2D,BD,70,00,B6,7E,6F,4C,B1,75,35,10,25,FE.D
7,39
230 REM PRINT OLDCHR
240 DATA34,06,B7,7E,91,F7,7E,93,B6,7E,6F,C6,04,3D,C3,7
F,AB,1F,01,A6,80,B7,7E,D5,A6,80,B7,7E,D7,A6,80,B7,7E,D
9,A6,80,B7,7E,DB,BD,70,D2,35,06,39
250 REM PRINT SPRITE
260 DATA34.06.B7.7E.91,F7,7E,93.B6.7E.6F.C6.04.3D.C3.7
E,DD,1F,01,A6,80,B7,7E,D5,A6,80.B7,7E,D7,A6,80,B7,7E,D
9,A6,84.B7,7E,DB,BD,70,D2,35,06,39,34,06,B7,7E,91,F7,7
E,93,BD,70,81,F7,7E,D5,7C,7E
270 DATA91,BD,70,81,F7,7E,D7,7A,7E,91,7C,7E,93,BD,70,8
1,F7,7E.D9,7C,7E,91,BD,70,81,F7,7E,DE,7A,7E,91,7A,7E,9
3,C6,04.B6,7E,6F,3D,C3,7F,6B,1F,01,B6,7E,D5,A7,80,B6,7
E,D7,A7,80,B6,7E,D9.A7,B0
200 DATAD6,7C,DD,A7,04,35,06,39,B6,7E,91,F6,7E,93,8E,0
6,00,30,86,30,89,01,00,5A,26,F9,C6,08,10,8E,7F,5D,A6,8
4,A7,A0,30,88,20,5A,26,F6,C6,00,F7,7F,F3,10,8E,7F,5D,8
6,08,3D,C3,75,69,1F,01,CA
290 DATA08,A6,A0,A1,80,26,07,5A,26,F7,F6,7F,F3,39,F6,7
F,F3,5C,F7,7F,F3,C1,00,26,DA,F6,7F,F3,39,B6,7E,D5,F6,7
E,91,F7,7F,ED,F6,7E,93,F7,7F,EB,BD,71,0F,7C,7E,91,B6,7
E,D7,BD,71,0F,7A,7E,91,7C
300 DATA7E,93,B6,7E,D9,BD,71,0F,7C,7E,91,B6,7E,DB,BD,7
1,0F,B6,7F,ED,F6,7F,EB,B7,7E,91,F7,7E,93,39,C6,08,3D,C
3,75,69,1F,02,8E,06
310 DATA00,B6,7E,91,F6,7E,93,30,86,30,89,01,00,5A,26,F
9,C6,08,A6,A0,A7,84,30,88,20,5A,26,F6,39
320 REM **COMMANDS**
330 REM CHAR
340 DATABD,8E,83,8C,00,FF,10,22,1A,4D,BF,7E,5F,B6,7E,6
0,C6,08,3D,C3,75,69,1F,02,C6,08,F7,7E,69,10,BF,7E,61,B
D,89,AA,BD,8E,83,8C,00,FF,10,22,1A,29,BF,7E,5F,10,BE,7
E,61,B6,7E,60,A7,A0,7A,7E,69,26,DE,16,03,0C
350 REM MOTION
360 DATABD,8E,83,BF,7E,6F,BD,89,AA,BD,8E,83,BF,7E,5F,B
6,7E,70,C6,01,3D,C3,7E,71,1F,01,B6,7E,60,A7,80,16,02,E
A
370 REM LOCATE
380 DATABD,8E,83,BF,7E,6F,BD,89,AA,BD,8E,83,BF,7E,91,B
D,89,AA,BD,8E,83,BF,7E,93,B6,7E,70,C6,02,3D,C3,7E,95,1
F,01,B6,7E,92,A7,80,B6,7E,94,A7,80,16,02,BA
390 REM SPRITE
400 DATABD,8E,83,BF,7E,6F,BD,89,AA,BD,8E,83,BF,7E,D5,B
D,89,AA,BD,8E,83,BF,7E,D7,BD,89,AA,BD,8E,83,BF,7E,D7,D
D,89,AA,BD,8E,83,BF,7E,DB,B6,7E,70,C6,04,3D,C3,7E,DD,1
F,01,B6,7E,D6,A7,80,B6,7E,D8,A7,80,B6,7E,DA,A7,80,B6,7
E,DC,A7,A0,16,02,AF
410 REM PX
420 DATABD,8E,83,BF,7E,6F,B6,7E,70,C6,02,3D,C3,7E,95,1
F,01,E6,80,7E,8C,36
430 REM PY
440 DATABD,8E,83,BF,7E,6F,B6,7E,70,C6,02,3D,C3,7E,95,1
F,01,30,01,E6,80,7E,8C,36
450 REM FLASH
460 DATABD,8E,83,BF,7F,EF,BD,89,AA,BD,8E,83,BF,7F,F1,B
E,7F,EF,B6,FF,22,8A,08,B7,FF,22,10,BE,7F,F1,31,3F,26,F
C,B6,FF,22,80,08,B7,FF,22,10,BE,7F,F1,31,3F,26,FC,30,1
F,26,DC,16,02,07
470 REM KEY
480 DATABD,B0,E5,27,FB,1F,89,7E,8C,36
490 REM TRIG1
500 DATAF6,FF,00,C4,01.7E,8C,36
510 REM TRIG2
520 DATAF6,FF,00,C4,02.54,7E,8C,36
530 REM XDIST
540 DATABD,8E,83,BF,7E,6F,BD,89,AA,BD,8E,83,BF,7E,5F,B
6,7E,70,C6,02,3D,C3,7E,95,1F,01,A6,84,B7,7E,91,B6,7E,6
0,C6,02,3D,C3,7E,95,1F,01,A6,84,B7,7E,93,B6,7E,91,B1,7
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(listing 1 continued on page 147)

(listing 1 continued from page 145)

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E,93,22,05,25,0D,16,01,D0,D0,7E,93,1F,E9,7E,8C,36,B6,7
E,93,B0,7E,91,1F,89,7E,8C,36
550 REM YDIST
560 DATABD,BE,83,BF,7F,AF,BD,A9,AA,BD,BF,83,BF,7E,5F,B
6,7E,70,C6,02,3D,C3,7E,95,1F,01,30,01,A6,84,B7,7E,91,B
6,7E,60,C6,02,3D,C3,7E,95,1F,01,30,01,A6,84,B7,7E,93,B
6,7E,91,B1,7E,93,22,B2,25,B8,16,01,5D
570 REM COINC
580 DATABD,BE,83,BF,7E,6F,B6,7E,70,B7,7E,6F,C6,02,3D,C
3,7E,95,1F,01,A6,80,E6,84,B7,7E,91,F7,7E,93,36,01,B7,7
E,70,C6,02,3D,C3,7E,95,1F,01,A6,80,B1,7E,91,26,15,A6,8
0,B1,7E,93,26,0E,B6,7E,6F,B1,7E,70,27,C6,F6,7E,70,7E,8
C,36,B6,7E,70,B1,1F,10,27,01
590 DATA0D,4C,20,CD
600 REM BLSPR
610 DATABD,BE,83,BF,7E,6F,B6,7E,70,B7,7E,6F,C6,02,3D,C
3,7E,95,1F,01,A6,80,E6,84,BD,6F,D3,16,C0,EC
620 REM LASER
630 DATA34,32,B6,FF,23,BA,08,B7,FF,23,EE,00,31,86,FD,B
7,FF,20,8D,19,7F,FF,20,8D,14,30,01,8C,C0,9B,25,FD,BA,F
F,23,84,F7,B7,FF,23,35,32,16,00,BF,1F,12,31,3F,26,FC,3
9
640 REM NUM
650 DATABD,BE,83,8C,00,1E,22,0C,BF,7E,5F,B6,7E,60,B7,7
5,35,16,00,A4,7E,8B,8D
660 REM CURSET
670 DATABD,8E,83,BF,7E,5F,BD,B7,AA,B6,7E,60,81,20,22,E
D,B7,75,67,BD,8E,83,BF,7E,5F,B6,7E,60,81,18,22,DD,B7,7
5,68,20,7C
680 REM PRINT ROUTINE
690 DATA1F,21,FC,75,67,34,06,A6,80,81,CD,26,0E,35,06,B
6,75,67,81,18,22,04,4C,B7,75,68,39,C6,08,3D,C3,75,69,1
F,02,35,06,BD,74,41,4C,81,20,25,D8,4F,5C,C1,18,25,D2,5
A,BD,74,5E,20,CC,34,36,8E,06,00,30,86,30,89,01,0C,5A,2
6,F9,C6,08,A6,A0,A7,84,30,88
700 DATA20,5A,26,F6,35,36,39,34,36,C6,00,34,04,BD,74,6
F,35,04,5A,26,F6,35,36,39,CC,0C,00,10,8E,06,00,CE,06,2
0,AE,C1,AF,A1,5A,26,F9,4A,26,F6,39
710 REM ROUTINES
720 DATA5F,7E,8C,36,F7,7E,6A,9E,68,8C,FF,FF,26,0C,39,3
4,10,BE,FF,FF,3F,7E,5D,35,90,20,E5,BF,7E,6B,BE,7E,5D,8
C,FF,FF,27,EB,32,62,BD,BA,C3,0F,6F,BE,7E,6D,9F,A6,7E,8
5,A8
730 REM TABLE
740 DATA43,48,41,D2,4D,4F,54,49,4F,CE,53,50,52,49,54,C
5,4C,4F,43,41,54,C5,50,D8,50,D9,46,4C,41,53,C8,54,52,4
9,47,B1,54,52,49,47,B2,48,45,D9,58,44,49,53,D4,59,44,4
9,53,D4,43,4F,49,4E,C3,42,4C,53,50,D2,4C,41,53,45,D2,4
6,52,45,C5,4D,4F,56,C5,4E,55
750 DATACD,43,55,52,53,45,D4
760 REM DISPATCH
770 DATA71,36,71,78,71,CA,71,9A,72,16,72,2C,72,44,72,0
7,72,BF,72,7D,72,98,72,E7,73,27,73,7A,73,98,8C,31,6E,A
4,73,CC,73,E3
780 REM DATA
790 DATA0D,45,58,54,45,4E,44,45,44,20,53,50,52,49,54,4
5,20,42,41,53,49,43,20,31,2E,30,0D,28,43,29,31,39,38,3
3,20,47,41,52,59,20,50,52,49,45,53,54,2E,2E,2E,0,0A,0A
800 POKE&H7E69,1
810 FOR A=&H7E7A TO &H7FF5:POKE A,32:NEXT
820 FOR A=28180 TO &H7568
830 READ A$:POKE A,VAL("&H"+A$)
840 NEXT
```

Listing 2.

```
00 0C 04 00 03 03 00 C0 80 18 18 18 18 00 10 19 00 28 2E 28
00 0C 00 00 03 24 24 FF 24 FF 24 24 00 08 3E 28 3E 0A 3E 6A
00 3C 48 24 03 2C 52 EC 80 00 14 14 38 3D 42 3D 00 10 10 10
00 0C 00 00 03 08 10 20 20 20 10 00 00 00 04 02 02 02 04 08
00 1E 54 38 3D 51 10 00 00 00 00 38 7F 08 08 08 00 00 00 00
18 1E 0E 10 03 03 00 00 7F 00 00 30 30 00 00 00 00 00 18 18
00 01 0C 04 03 13 30 40 00 3C 66 5E 7E 76 66 3C 00 18 38 18
10 1E 1E 3C 03 3C 66 0E 0C 18 30 7F 00 3C 66 06 1C 06 66 3C
00 0E 1E 3C 66 7E 0E 0E 60 7E 60 7C 06 06 66 3C 00 3C 66 60
7C 66 66 3C 00 7E 06 06 0C 18 30 40 00 3C 66 66 3C 66 66 3C
00 3C 66 66 3E 06 66 3C 00 00 18 18 00 18 18 00 00 18 18 00
18 18 0E 10 00 0E 0C 04 00 04 02 31 30 00 00 7E 00 7E 00 00
00 0E 4C 20 18 20 10 00 60 30 66 3C 3C 10 00 10 00 38 44 04
34 54 54 38 00 18 3C 66 66 7E 66 66 00 7C 66 66 7C 66 66 7C
00 3C 66 60 60 60 66 3C 00 78 6C 66 66 66 6C 78 00 7E 60 60
7C 60 60 7E 00 7E 60 60 7C 60 60 60 00 3C 66 60 6E 66 66 3C
00 66 66 66 7E 66 66 66 00 3C 18 18 18 18 18 3C 00 06 06 06
06 06 66 3C 00 66 6C 78 70 78 6C 66 00 60 60 60 60 60 60 7E
00 66 7E 7E 66 66 66 66 00 66 76 7E 7E 6E 66 66 00 3C 66 66
66 66 66 3C 00 7C 66 66 7C 60 60 60 00 3C 66 66 66 76 6C 3A
00 7C 66 66 7C 6C 66 66 00 3C 66 60 3C 06 66 3C 00 7E 18 18
18 18 18 18 00 66 66 66 66 66 66 3C 00 66 66 66 66 66 3C 18
00 66 66 66 66 7E 7E 66 00 66 66 3C 18 3C 66 66 00 66 66 3C
18 18 18 18 00 7E 06 0C 18 30 60 7E 00 70 40 40 40 40 40 70
00 80 40 20 10 08 04 02 00 0E 02 02 02 02 02 0E 00 10 38 54
10 10 10 10 00 00 20 40 FE 40 20 00 FF C7 BB FB CB AB AB C7
00 00 00 3C 06 3E 66 3E 00 30 60 7C 66 66 66 7C 00 00 00 3C
66 60 66 3C 00 06 06 3E 66 66 66 3E 00 00 00 3C 66 7E 60 3C
00 3C 66 60 78 60 60 60 00 30 7C 14 44 7C 04 7C 00 60 60 7C
66 66 66 66 00 18 00 18 18 18 18 18 00 00 00 00 06 00 48 38
00 60 66 6C 78 6C 66 6C 00 18 18 18 18 18 18 18 00 00 00 66
7E 7E 66 66 00 00 00 7C 66 66 66 66 00 00 00 3C 66 66 66 3C
00 00 7C 41 44 3C 40 40 00 30 7C 44 44 7C 05 02 00 00 00 7C
66 60 60 60 00 00 00 3C 60 3C 06 3C 00 00 18 3C 18 18 18 0C
00 00 00 66 66 66 66 3E 00 00 00 66 66 66 3C 18 00 00 00 66
66 7E 7E 63 00 00 00 66 3C 18 3C 66 00 00 6C 6C 6C 7C 04 7C
0C 00 00 7C 0C 18 30 7C FF BF BF BF FF BF BF DF FF 7F EF DF
EF F7 FB FD FE F1 FD FD FD FD FD F1 FF EF C7 AB EF EF EF EF
FF FF DF EF 01 DF DF FF 7F 7F FF FF FF FF FF FF FF FF
```

(continued from page 145)

Before you type in the listing of the main machine code — listing 1, type:

CLEAR 200,28179

Then type in listing 2.

When you have checked that all the data is correct you can save the machine-code routine with the command:

CSAVEM"SPRITES",28180,32766,28180

You can now execute the machine code by typing:

EXEC 28180

You should see the message

EXTENDED SPRITE BASIC 1.0
© 1983 GARY PRIEST...

You are now in extended sprite Basic. To get some idea of what is posible with your new extended Basic enter the sprite demonstration program in listing 5. This program sets up the sprite attributes for the first eight sprites and defines four characters as one single man.

Four sprites start at the top of the screen and four at the bottom. These two groups go up and down the screen. When they reach the top or the bottom they bounce off the edges.

If you press Enter you will hear an odd sound — this is the sound produced by the !Laser command. The eight sprites will be blanked out and sprite two will be defined as a rough football. Sprite one is defined as a man. The man runs up to the football and kicks it.

When sprites move they do not destroy whatever they pass over as long as it is a defined character. To demonstrate this there is a third part of the demonstration program.

To write your own programs that use sprites you must first understand what each new command does and the syntax for using it. You must also know how to define characters and sprites.

To define a character for use in PMode, 4,1 you must draw an 8 by 8 grid and draw your characters in the grid.

To be able to use the !Char command you must have eight pieces of data. These eight bytes make up the character. Take the top row. Look at the eight squares in the row. Add up the numbers above the filled in squares. eg., 4+8+16+32=60 so the first piece of data is 60. The whole man would be:

X=!CHAR chr no,60,60,60,24,255,
24,36,66

Listing 3.

```
10 REM LISTING THREE
11 REM
20 PMODE3:PCLS:SCREEN1,0
30 COLOR2
40 A$=INKEY$:IF A$="" THEN 40
50 IF A$>"0" AND A$<"5" THEN COLOR VAL(A$)
60 IF A$=CHR$(8) AND X>0 THEN X=X-1
70 IF A$=CHR$(9) AND X<7 THEN X=X+1
80 IF A$=CHR$(94) AND Y>0 THEN Y=Y-1
90 IF A$=CHR$(10) AND Y<7 THEN Y=Y+1
100 IF A$=CHR$(13) THEN 130
110 PSET(X,Y)
120 GOTO40
130 CLS:FOR A=1536 TO 1760STEP32:PRINTPEEK(A):NEXT
```

To design multicolour characters type in listing 3. Keys 1-4 change the colour and the arrow keys are used to draw your characters. When you are satisfied with your character press Enter. The program will print the eight pieces of data for you to use in a !Char statement.

To define a sprite you must use four characters that you have previously defined.

There are 11 new commands for the handling of sprites:

!SPRITE — This command is for defining sprites. You can define sprites 1-29 inclusive.

To use the command you must give the sprite number and four character numbers that make up the sprite eg.

X=!SPRITE 1,65,66,67,68

(continued on page 149)

(continued from page 147)

would define sprite 1 assuming that you have defined the letters of the alphabet. The character number may be 0-254.

!NUM — This command is used to control the number of sprites appearing on screen. You may have up to 29 sprites on screen at once.

To use the command you must add one to the number of sprites that you are going to use e.g., if you want two sprites then you must use

X = !NUM 3

!LOCATE — This command positions a sprite on the high resolution screen. You must use the sprite number, X co-ordinate (0-30), and the Y co-ordinate (0-22).

!MOTION — This command sets the direction in which a sprite is to move.

0 = STOP, 1 = UP, 2 = RIGHT,
3 = DOWN, 4 = LEFT.

To set the motion of sprite 1 use X= MOTION 1, direction.

!MOVE — This calls the machine code sprite move routine. It moves the sprites selected by !Num and that do not have a motion of 0.

When a sprite is about to move off the screen it stops automatically.

!PX — This returns the X co-ordinates of a chosen sprite eg., if sprite 1 is at 10,10 then using:

X = !PX 1

will return the value 10 in the variable X.

!PY — This works in the same way as !PX but returns the Y co-ordinate instead.

!XDIST — This command returns the distance between the X co-ordinates of two sprites eg.,

X = !XDIST 1,2

returns the difference between the X co-ordinates of sprites 1 and 2.

!YDIST — This command works in the same way as !XDist but returns the difference between the Y co-ordinates of two sprites.

!COINC — This command is used to detect collisions between two sprites.

If sprite is at 10,10 and so is sprite 3 then if you use

X = !COINC 1

then X will equal 3 or if you use

X = !COINC 3

then X will will equal 1. If sprite 3 was at 9,9 then

X = !COINC 1

would equal 0.

!BLSPR — This is useful for blanking out a certain sprite eg., if sprite 1 has come to the edge of the screen and has stopped then use

X = !BLSPR 1

This will not blank out whatever is underneath sprite 1.

There are eight new commands that are not for controlling sprites.

!CHAR — This command is used to define characters. You may define characters 0-254. You must give the character number and then the eight pieces of data separated by commas eg.,

X = !CHAR 32,0,0,0,0,0,0,0,0

will define character 32 as a space.

Listing 2 gives data for defining characters 32 to 128.

!FLASH a,b — This flashes the screen 'a' times with a delay of 'b' between flashes. ie.,

X = !FLASH 10,20000

!TRIG1 — This returns 0 if the fire button on the right joystick is pressed or 1 if not.

!TRIG2 — This works the same as !Trig1 but for the left joystick.

!KEY This waits for you to press a key. The ASCII value is returned ie., if you pressed A then 65 would be returned. If you press Break then 3 will be returned and the program will not Break.

!LASER — This produces a simple laser sound eg.,

X = !LASER

!FREE — This replaces the Dragon's Mem function. Try

PRINT MEM

You should get the result 0. Now try

PRINT! FREE

this gives you the amount of memory left.

!CURSET x,y — sets the position for printing on the high resolution screen. x is the x co-ordinate which may be between 0-32 and y is the y co-ordinate between 0-23.

To print on the high resolution screen, make a string of the characters you wish to print and add a carriage return ie.,

A$ = "DRAGONS RULE OK" + CHR$(13)

Make sure that near the beginning of the program you have a line stating:

DEFUSR 0 = &H7408

When you are ready to print, type

X = USR0(VARPTR(A$))

and the contents of A$ should be printed on the high resolution screen.

Please note that whatever variables I have used can be changed to whatever you like.

When a command needs numbers after it you can use variables ie., instead of

X = !NUM 3

you could give variable A the value of 3 and have

X = !NUM A

If anyone does not feel up to typing in the programs they can obtain a cassette tape of the programs from me at 167 Ludlow Road, Itchen, Southampton SO2 7EL. The cassette costs £3.

Listing 4.

```
20 REM ***SPRITE DEMO***
30 PMODE4:PCLS:SCREEN1,1
40 Q=!NUM 9:REM USE 8 SPRITES
50 REM DEFINE THE 4 CHRS
60 Q=!CHAR128,7,13,13,15,12,7,1,127:REM TOP LEFT OF MA
N
70 Q=!CHAR129,224,176,176,240,48,224,128,254:REM TOP R
IGHT OF MAN
80 Q=!CHAR130,127,1,1,2,4,8,16,32:REM BOTTOM LEFT OF M
AN
90 Q=!CHAR131,254,128,128,64,32,16,8,4:REM BOTTOM RIGH
T OF MAN
100 REM DEFINE THE SPRITES
110 FOR A=1 TO 8
120 Q=!SPRITE A,128,129,130,131:NEXT
130 REM LOCATE SPRITES
140 FOR A=1 TO 8:READ X,Y:Q=!LOCATE A,X,Y:NEXT
150 DATA1,0,8,0,15,0,23,0,4,20,11,20,18,20,26,20
160 REM GIVE THE SPRITES A DIRECTION
170 FOR A=1 TO 4:D1(A)=3:D2(A)=1:NEXT
180 FOR A=5 TO 8:D1(A)=1:D2(A)=3:NEXT
190 FOR A=1 TO 8:Q=!MOTION A,D1(A):NEXT
200 REM MOVE THOSE SPRITES
210 Q=!MOVE
220 P=!PY5:REM P=Y COORDINATE OF SPRITE 5
230 IF P=0 THEN GOSUB270:REM IF SPRITE 5 IS AT TOP OF
SCREEN THEN CHANGE DIRECTION OF ALL SPRITES SO THAT TH
EY BOUNCE
240 IF P=22 THEN 190:REM IF AT BOTTOM THEN CHANGE DIRE
CTION SO THAT THEY BOUNCE
250 A$=INKEY$:IF A$=CHR$(13) THEN 290
260 GOTO210:REM MOVE THOSE SPRITES AGAIN
270 FOR A=1 TO 8:Q=!MOTION A,D2(A):NEXT
280 RETURN
290 Q=!LASER:IF FLAG=1 THEN 720
300 REM FLASH THE SCREEN
310 Q=!FLASH10,20000
320 SCREEN1,1
330 REM BLANK OUT THE SPRITES
340 REM PCLS WILL DO THE SAME
350 FOR A=1 TO 8:Q=!BLSPR A:NEXT
360 Q=!NUM3:REM USE 2 SPRITES
370 Q=!LOCATE1,2,10
380 Q=!MOTION1,2:REM IT'S GOING RIGHT
390 REM DEFINE A ROUGH FOOTBALL
400 Q=!CHAR132,255,255,255,255,255,255,255,255
410 Q=!CHAR32,0,0,0,0,0,0,0,0
420 Q=!SPRITE2,32,32,132,32
430 Q=!LOCATE2,20,11
440 Q=!MOTION2,1
450 REM MOVE THAT FOOTBALLER
460 Q=!MOVE
470 Q=!MOTION2,0
480 FOR A=1 TO DL:NEXT
490 TEST=!XDIST1,2:IF TEST=2 THEN 510:REM HAS HE REACH
ED THE FOOTBALL
500 GOTO460
510 Q=!MOTION1,0:REM STOP FOOTBALLER
520 Q=!MOTION2,2:REM SET BALL IN MOTION
530 Q=!MOVE:REM MOVE THE BALL
540 TEST=!PX2:IF TEST=30 THEN GOTO 570
550 FOR A=1 TO DL:NEXT
560 GOTO530
570 CLS:PRINT"*****ACTION REPLAY*****"
580 FOR A=1 TO 1000:NEXT
590 IF DL=70 THEN 630
600 DL=70
610 SCREEN1,1:PCLS
620 GOTO330
630 DEF USR0=&H7408:REM ADDR OF PRINT ROUTINE
640 Q=!CURSET0,12:REM PRINT AT 0,12
650 CLS:PRINT"THE SPRITES DO NOT DESTROY ANY  DEFINED
CHARACTERS THAT THEY    PASS OVER!':PRINT"PLEASE PRESS
 A KEY AND WATCH "
660 Q=!KEY
670 SCREEN1,1:PCLS
680 Z$=STRING$(32,132)+CHR$(13):Q=USR0(VARPTR(Z$)):REM
 PRINT Z$
690 RESTORE
700 FLAG=1
710 GOTO40
720 CLS:PRINT"THAT WAS THE END OF THE DEMO    PROGRAM!
":END
```



TOOLKIT

John Charlesworth takes the hassle out of program writing.

TOOLKIT PROGRAMS have been published before, mostly concerned only with graphics and/or sound. This is all very well but first you need to have written a Basic program to use them and because of the nature of Basic the result is very often a mess, tailends of unwanted programs and line numbers going up in random steps.

This program is designed to aid the program writer by providing a number of useful, user friendly routines to take a lot of the work out of program writing and developing. The first and most important of these is the renumber routine. Renumber routines have been published before but these were all very limited as all they could do was renumber the line numbers, not the Goto, Gosub etc. This renumber routine is different, it will renumber the program using a specified start and step value and after renumbering the line numbers it will renumber all the Goto's, Gosubs, Run, Lists, LLists, and restores. The only disadvantages, and these are very small, are:

- The routine will not renumber lines as: SAVE "filename" LINE number
- The routine will not renumber lines of the form Goto calculation. For example: GOTO 1000 + (100 AND x = 3) + (200 AND x = 7)
- The routine will not renumber Gotos etc. which refer to non-existant lines.

In the event of the first or third occuring the computer will ignore it but in the event of the second the computer will print the message

Can't renumber line nnnn

nnnn being the offending line and the routine will return having done nothing.

The second routine provided by this toolkit is a Rem kill routine. During program development Rem statements are very useful but when the program is finished they no longer serve any purpose and simply slow down loading and saving so what this program does is search through the program for Rem statements and when it finds one it deletes it.

The third routine is a block delete. This program will remove all the lines between two specified lines and is useful for example to

(continued on page 153)

Listing 1.

```
  10 DEF FN x(a$)=16*(CODE a$-48
-(39 AND a$(1)>"9"))+(CODE a$(2)
-48-(39 AND a$(2)>"9"))
  20 CLEAR 31270: PRINT "Poking
in progress": LET x=31276
  30 FOR a=0 TO 20: READ a$: LET
 t=0: LET t1=VAL a$( TO 4): LET
a$=a$(5 TO )
  40 FOR b=0 TO 63: LET v=FN x(a
$(b*2+1 TO b*2+2)): POKE x,v: LE
T t=t+v: LET x=x+1: NEXT b
  50 IF t<>t1 THEN PRINT "Error
in line ";100+a*10: STOP
  60 NEXT a: PRINT "Finished": S
TOP
 100 DATA "7505cd367acd967ccddc7
cc92a535ced5b4b5ca7ed5219c82be5d
de123232323237efe0e2006232323232
3237efe0d281bfee12824fee52820fee
c281cfeed2818fe"
 110 DATA "7046f02814fef72810231
8d5ed5b4b5c1b1ba7ed521938c1c9237
efe0d28edfe3a28befe0e20072323232
32318ebfe303806fe3a300218e1dde5c
d6b0dcdcd1f21c3"
 120 DATA "64437a7efe0d2804d7231
8f7dde1dd4601dd4e02cd1b1ac1c9160
00043616e27742077656e75646272722
06c696e65200d3eff18023e2fa73ced5
230fb19c9e53e0a"
 130 DATA "7388a711e803ed5219301
33da7116400ed521930093ca71e0aed5
230013de1c9e5e5eb131afe0e20fa7bc
6053001145fe1d5eba7ed527dd1e1c9e
511e803a7ed5219"
 140 DATA "44933013116400a7ed521
9300f1e0aa7ed5219300f1814cddf7a0
203116400cddf7a02c31e0acddf7a020
37dc63002033e0e02039702030203e17
d02037c02039702"
 150 DATA "8696c9fd2a535cfd2bfde
5c1fd5e03fd560413131313fd19fde5d
1a7ed521930e8c5fde1c916005ffe0a3
80115cddf7dfc6604fd6e0219fd7404f
d7503fde5e1d5dd"
 160 DATA "8158e5d1a7ed521930004d
1dd19c9d1c9e5cd0a7b472a005bcde97
ae1e5b8281b9023f5eb2a615ca7ed524
44d626bed44853001246fedb0f1cd8f7
b2a005bc103cd24"
 170 DATA "73557bc9e5cd0a7b472a0
05bcde97ae1e5b828e79023f5eb2a615
ca7ed52444d19545d833001145fedb81
8cbe5237efe0d2810fe3a200cfe0e280
afe303804fe3a38"
 180 DATA "6781eae1c92323235e235
6dd6601dd6e02a7ed521920ece1e5cd6
d7b3a025bfe002005cdba7b1803cdee7
be123c92a535e232323237efe0d2825f
e0e200423231 8ef"
 190 DATA "7534fee12814fee52810f
eec280cfeed2308fef02804fef720dac
d167c18d5ed5b4b5c1b1ba7ed521938c
6c9f3fde5dd2a535cdd2b3e0032025b2
1000022005bcd58"
 200 DATA "73807c2a005bdd7401dd7
502dd5e03cd5604dd19110400dd192a0
05b2322005bdde5e1ed5b4b5c1ba7ed5
21938d2fde1fbc9f3fde52a4b5c2b2bc
d6d7bfde5dde1dd"
 210 DATA "68864e02dd46012a035be
d5b055b97190bb920fbb820f8444de34
3005b3e0132025bcd587c2a005bdd740
1dd7502ed4b055ba7ed4222005bdde5e
12bcd6d7bfde5dd"
 220 DATA "7633e12a035bed5b055ba
7ed52ed5b005ba7ed521920cbfde1fbc
92a4b5ced5b535c131313a7ed5219d8d
d2a535cdd2bdde5e1232323232237efe0
e20032318f3feea"
 230 DATA "705828.4fe0d20efe5dde
1ed5b4b5c1b1ba7ed521730dcc9cde5d
11313131313a7ed521928350100002b5
45d03131afe0d20f9ebe5d5210000a7e
d42ebdd6604dd6e"
 240 DATA "806703:9dd7503dd7404c
ddf7dd1a7ed52444de1edb0dde5e1189
8dde5e1dd5604dd5e03191104 0019ddc
5d1e5d5eba7ed52eb18d52a4b5c19224
b5c2a595c192259"
 250 DATA "69015c2a615c192261 5cc
9dd2a535cdde5e1ed5b4b5c1b1ba7ed5
2d0dc2b2a035bdd5e02dd5601eba7ed5
219eb301ccd5e03dd5604dd19110400d
d19ed5b4b5c1b1b"
 260 DATA "7322dde5e1a7ed5238d4c
9dd22035b2a055bdd5e02dd5601eba7e
d5219eb301ddd5e03dd5604dd1911040
0dd19ed5b4b5c1b1bdde5e1a7ed5238d
4180f200ddd5e03"
 270 DATA "7586dd5604dd19110400d
d19dd22055b2a615ced5b055ba7ed524
44debed5b035bedb02a035bed5b055ba
7ed52ebcddf7dc9cd6b0dcdcd1f3e16d
797d797d72a595c"
 280 DATA "7700ed5b4b5c1313a7ed5
2d82a4b5c463e1fa0c640477ee6e0fe6
0200878d7110600191853fea0200c78d
7237efe8038f9d68018e9fee0200d78f
53ef3d7f1d71113"
 290 DATA "5986001918 32fe8020107
8d73e28d73e29d7235e23562319181ef
e40200d78d73e24d7235e23561923180
d78d73e24d73e28d73e29d718ebed5b5
95c3e06d71ba7ed"
 300 DATA "3596521938893e0dd73e4
dd73e65d73e6dd73e3dd72a595ced5b4
b5ca7ed52444dc900000000000000000
000000000000000000000000000000000
000000000000000"
9994 CLS : PRINT '1) Renumber"'"
2) Remkill"'"3) Delete"'"4) Vari
able list': INPUT fff: LET zzz=(
31276 AND fff=1)+(32069 AND fff=
2)+(32245 AND fff=3)+(32412 AND
fff=4): IF NOT zzz THEN GO TO 99
94
9995 LET ttt=1: LET fff=1: IF zz
z=31276 THEN INPUT "Start ";fff,
"Step ";ttt
9996 IF zzz=32245 THEN INPUT "Fr
om ";fff,"To ";ttt
9997 IF fff>9999 OR fff<1 OR ttt
>9999 OR ttt<1 OR (fff>ttt AND z
zz=32245) THEN GO TO 9994
9998 POKE 23300,INT (fff/256): P
OKE 23299,fff-256*PEEK 23300: PO
KE 23302,INT (ttt/256): POKE 233
01,ttt-256*PEEK 23302: IF zzz=32
412 THEN PRINT USR zzz: STOP
9999 RANDOMIZE USR zzz
```

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Listing 2.

```
 10 DEF FN x(a$)=16*(CODE a$-48
-(39 AND a$(1)>"9"))+(CODE a$(2)
-48-(39 AND a$(2)>"9"))
 20 CLEAR 64040: PRINT "Poking
in progress": LET x=64048
 30 FOR a=0 TO 20: READ a$: LET
 t=0: LET t1=VAL a$( TO 4): LET
a$=a$(5 TO )
 40 FOR b=0 TO 63: LET v=FN x(a
$(b*2+1 TO b*2+2)): LET t=t+v: P
OKE x,v: LET x=x+1: NEXT b
 50 IF t=t1 THEN NEXT a: PRINT
"Finished": STOP
 60 PRINT "Error in line ";100+
a*10: STOP
 100 DATA "7901cd3afacd9afccde0f
cc92a535ced5b4b5ca7ed5219c82be5d
de123232323237efe0e2006232323232
3237efe0d281bfee12824fee52820fee
c281cfeed2818fe"
 110 DATA "7050f02814fef72810231
8c5ed5b4b5c1b1ba7ed521738c1c9237
efe0d28ed-e3a28befe0e20072323232
32318ebfe30380afe3a300218e1dde5c
d6b0dcdcd1f21c7"
 120 DATA "657:fa7efe0d2804d7231
8f7dde1dd4601dd4e02cd1b1ac1c9160
0C0436146e77420726562756c626572
0ec696e65200d3eff18023e2fa73ced5
230fb19c9e53e0a"
 130 DATA "7388a711e803ec5219301
33da7116400ed521930093da71e0aed5
230013de1c9e5e5eb131afe0e20-a7bc
6C53001145fe1d5eba7ed527cd1e1c9e
511e803a7ed5219"
 140 DATA "48893013116400a7ed521
9300f1e0aa7ed5219300f1814cde3fa0
2C3116400cde3fa02031e0acce3-a020
37dc63002033e0e02039702030203e17
dC2037c02039702"
 150 DATA "8828c9fd2a535cfd2bfde
5c1fd5e03fd5604131313fd19-de5d
1a7ed521930e8c5fde1c9160C5ffe0a3
80115cde3fdfd6604fdee0315fd7404f
d7503fde5e1d5dd"
 160 DATA "8558e5d1a7ed52193004d
1dd19c9d1c9e5cc0efb472a0C5bcdedf
ae1e5b8281b9023f5eb2a615ca7ed524
44d626bed4485300124afedb0f1cd93f
b2a005bc103cd28"
 170 DATA "7747fbc9e5cd0efb472a0
05bcdedfae1e5b828e79023f5eb2a615
ca7ed52444d17545d833001145fedb81
8cbe5237efe0d2810fe3a280cfe0e280
afe303804fe3a38"
 180 DATA "7177eae1c92323235e235
6dd6e01dd6e02a7ed521920ece1e5cd7
1fb3a025bfe002005cdbefb1303cdf2f
be123c92a535c232323237efe0c2875f
e0e2004232318ef"
 190 DATA "7770fee12814fee52810f
eec280cfeed2808fef02804fef720dac
d1afc18d5ed5b4b5c1b1ba7ed521938c
6c9f3fde5dd2a535cdd2b3e0032025b2
100C022005bcd5c"
 200 DATA "8140fc2a005bdd7401dd7
502dd5e03dd5604dd19110400dd192a0
05b2322005bdde5e1ed5b4b5c1ba7ed5
21938d2fde1fbc9f3fde52a4b5c2b2bc
d71fbfde5dde1dd"
 210 DATA "71504e021d46012a035be
d5bC55b97190bb920fb5820f8444ded4
3005b3e0132025bcd5cfc2a005bdd740
1dd7502ed4b055ba7ed4222005bdde5e
12bcd71fbfde5dd"
 220 DATA "7633e12a035bed5b055ba
7ed52ed5b005ba7ed521920cbfde1fbc
92a4b5ced5b535c131313a7ed5219d8d
d2a535cdd2bdde5e123232323237efe0
e20032318f3feea"
 230 DATA "70582014fe0d20efe5dde
1ed5b4b5c1b1ba7ed521938dcc9dde5d
1131313131313a7ed52192835010000 2b5
45d03131afe0d20f9ebe5d5210000a7e
d42ebdd6604dde"
 240 DATA "8199C319dd7503dd7404c
de3fdc1a7ed52444de1edb0dde5e1189
8dde5e1dd5604dd5e03191104001 9dde
5d1e5c5eba7ed52eb18d52a4b5c19224
b5c2a595c192259"
 250 DATA "69015c2a615c1922615cc
9dd2a535cdde5e1ed5b4b5c1b1ba7ed5
2d0dd2b2a035bdd5e02dd5601eba7ed5
219eb301cdd5e03dd5604dd19110400d
d19ed5b4b5c1b1b"
 260 DATA "7322dde5e1a7ed5238d4c
9dd22C35b2a055bdd5e02dd5601eba7e
d5219eb301ddd5e03dd5604cd1911040
0dd19ed5b4b5c1b1bdde5e1a7ed5238d
418Df200ddd5e03"
 270 DATA "77:8dd5604dd19110400d
d19dd22055b2a615ced5b055ba7ed524
44debed5b035bedb02a035bed5b055ba
7ed52ebcde3fdc9cd6b0d:dcd1f3e16d
797d797d72a595c"
 280 DATA "7700ed5b4b5c1313a7ed5
2d82a4b5c463e1fa0c640477eebe0fe6
020087 8d7110600191853fea0200c78d
7237efe8038f9d6801 8e9fee0200d78f
53ef3d7f1d711:3"
 290 DATA "5986001918 32fe802C107
8d73e28d73e29d7233e233623191E1ef
e40200d78d73e24d7235e23561923180
d78d73e24d73e28d73e29d718ebed5b5
95c3e06d71ba7ed"
 300 DATA "547952193839 3e0dd73e4
cd73e65d73e6dd73e3dd72a595ced5b4
b5ca7ed52444dc98777761b03130C3e0
03c42427e424200007c427c42427c000
03c424040423c00"
9994 CLS : PRINT "1) Renumber"'"
2) Remkill"'"3) Delete"'"4) Vari
able list": INPUT fff: LET zzz=(
64048 AND fff=1)+(64841 AND fff=
2)+(65017 AND fff=3)+(65184 AND
fff=4): IF NOT zzz THEN GO TO 99
94
9995 LET ttt=100: LET fff=ttt: I
F zzz=64048 THEN INPUT "Start ";
fff,"Step ";ttt
9996 IF zzz=65017 THEN INPUT "Fr
om ";fff,"To ";ttt
9997 IF fff>9999 OR fff<1 OR ttt
>9999 OR ttt<1 OR (fff>ttt AND z
zz=65017) THEN GO TO 9954
9993 POKE 23300,INT (fff/256): P
OKE 23299,fff-256*PEEK 23300: PO
KE 23302,INT (ttt/256): POKE 233
01,ttt-256*PEEK 23302: IF zzz=65
184 THEN PRINT USR zzz: STOP
9999 RANDOMIZE USR zzz
```



(continued from page 151)

remove all unused sections of programs.

The final routine is a variable list. This routine when called will list all the variables used by the program so far and how much total memory is being used.

The routines together take up about 1300 bytes. To enter them, type in listing 1 — for the 16K version — or listing 2 — for the 48K version. When run these programs Poke in the machine code from hex data statements, above Ramtop. Run the program and if the program reports finding a data error, correct the offending line and Return until the program prints "finished".

The routines should now be in place and error free — a checksum checks each line — and so the data is no longer needed and so should be deleted. However the toolkit can help you here. Run line 9994 and type 3 in response to the menu to select the block delete. The computer will then ask for the first and last lines to be deleted so type 1 then 1000.

The routines should now be saved using

SAVE "TOOLKIT":SAVE "BYTES"

Listing 3.

```
  1 RUN 3
  3 FOR a=3 TO 4: NEXT a: DIM a
$(3,2): DIM x(7)
 10 PRINT "hello": REM title
 17 LET b$="string variable"
 20 GO SUB 100: RESTORE 10: LLI
ST 17: LIST 100
 30 GO TO z*100
100 LET z=1: RETURN
110 REM the end
```

CODE 31276, 1300

for a 16K Spectrum or

SAVE "TOOLKIT":SAVE "BYTES" CODE 64048,1330

for a 48K Spectrum. To load the program in future type

LOAD "":CLEAR 31270 LOAD "" CODE

for the 16K Spectrum or

LOAD "":CLEAR 64040:LOAD "" CODE

for the 48K Spectrum.

If you now type in listing 3 — do not delete lines 9994-9999 — you may test out the other routines.

Run the toolkit — Run 9994 — and the menu will be printed out. You may notice from the listing that there are a couple of unnecessary Rem statements so why not delete them. In response to the menu type 2 to get the Rem delete. If you now list the program you will see the Rem statements have disappeared. Renumber the program.

Type Goto 9994 and in response to the menu type 1 to get the renumber routine and then in response to the promps type the lowest line number you want, 10 is normal, and to the second prompt type the step between successive lines, again 10 is normal. Immediately the message

Cor't rentmber line30

will appear. If you list the program you can see the problem — line 30 has a Goto calculation. Delete line 30 — you could always replace it later — and again type Goto 9994 and type in the responses as before. You may get an error message when renumbering is complete. It should be ignored.

To test the final routine type Goto 70 and in response to the menu type 4. The variables used should be listed on the screen and the total memory printed at the bottom. ■

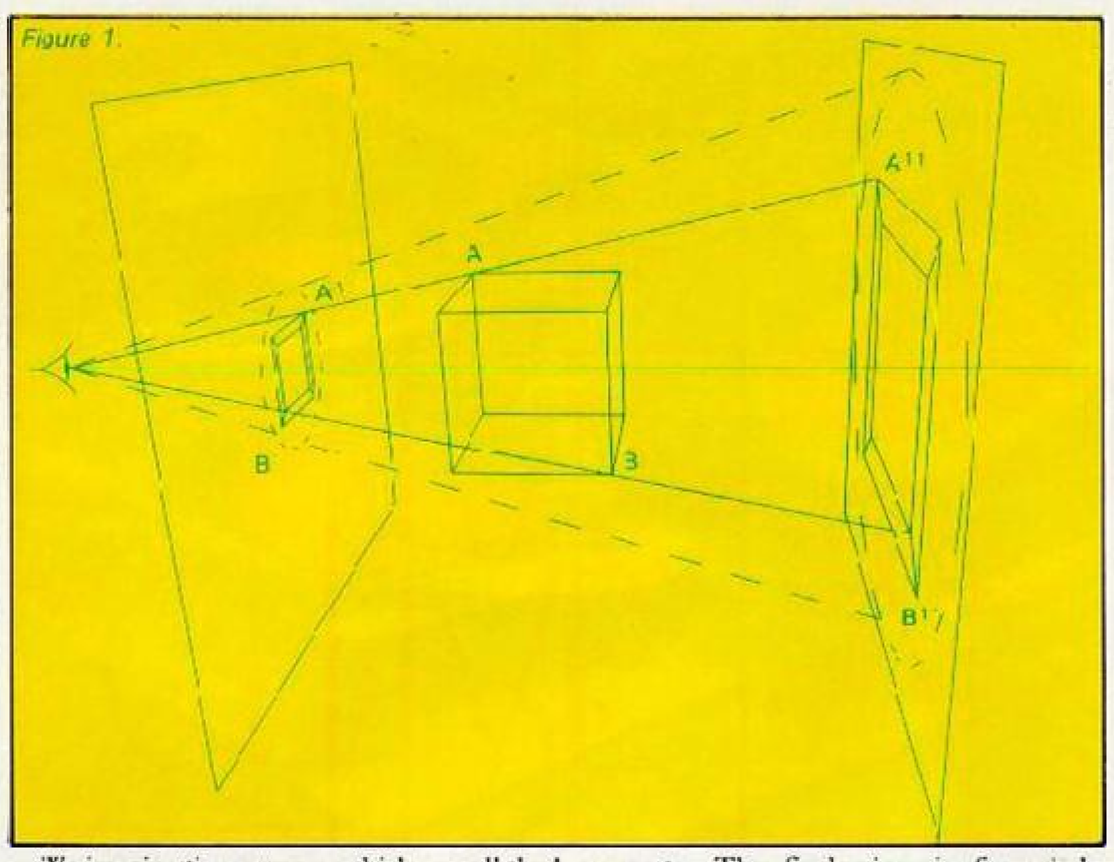
PERSPECTIVE AND PROJECTIONS

IN A PREVIOUS ARTICLE in the February edition of *Your Computer* I gave a method for drawing pictures of three dimensional wire-objects on the screen of a BBC micro. I looked at the simplest type of projection which maps a 3-D scene onto a 2-D screen. This orthographic projection has the property that parallel lines in 3-D space are projected into parallel lines on the screen. Although very useful, such views do look odd! Our brains are used to the perspective phenomenon of 3-D space, and so they attempt to interpret orthographic pictures as if they are perspective views and so they look distorted.

So it is essential to produce a projection which displays perspective phenomena ie;. parallel lines should meet on the horizon: an object should appear smaller as it moves away from the observer. The drawing board methods devised by artists over the centuries are of no value to us. Three dimensional co-ordinate geometry, however, furnishes us with a relatively straightforward technique.

A perspective view

To produce a perspective view we introduce a very simple definition what we mean by vision. We imagine every visible point in space sending out a ray which enters the eye. Naturally the eye cannot see all of space, it is limited to a cone of rays which fall on the retina, the so-called cone of vision, which is outlined by the dashed lines of figure 1. The axis of this cone is called the straight-ahead ray. We imagine that the eye at the origin and the straight ahead ray identified with the positive z-axis of our co-ordinate system.



We imagine the screen — which we call the perspective plane — perpendicular to the axis of the cone of vision at a distance from the eye. In order to form the perspective projection we mark the points of intersection of each ray with this plane. Since there are an infinity of such rays this appears to be an impossible task. Actually the problem is not that great because we need only consider the rays which emanate from the important points in the scene eg. the vertices at the ends of line segments. The final view is formed by drawing lines between the projected points on the screen in exactly the same way as the equivalent vertices are related in 3-D space.

Figure 1 shows a cube observed by an eye and projected onto two planes: and the whole scene is also drawn in perspective. Two example rays are shown: the first from the eye to A, one of the near corners of the cube relative to the eye, and the second to B one of the far corners of the cube. The perspective

Listing 1.

```
10REM MAIN PROGRAM
110INPUT"Which MODE"MODE : MODE MODE
120INPUT"HORIZ",HORIZ : VERT=3*HORIZ/4
130PROCstart(3,0)
140PROCsetorigin(HORIZ/2,VERT/2)
150PROCscene3
160END
5000REM genrot / rotate space about a general axis
5010DEF PROCgenrot(PX,PY,PZ,QX,QY,QZ,GAMMA)
5020LOCAL ALPHA,BETA
5030PROCtran3(-PX,-PY,-PZ) : PROCmult3
5040ALPHA=FNangle(QX,QY)
5050PROCrot3(-ALPHA,3) : PROCmult3
5060BETA=FNangle(QZ,SQR(QX*QX+QY*QY))
5070PROCrot3(-BETA,2) : PROCmult3
5080PROCrot3(GAMMA,3) : PROCmult3
5090PROCrot3(BETA,2) : PROCmult3
5100PROCrot3(ALPHA,3) : PROCmult3
5110PROCtran3(PX,PY,PZ) : PROCmult3
5120ENDPROC
8200REM look3 / maintain vertical
8210DEF PROClook3
8220LOCAL FX,FY,FZ,THETA
8230CLS : INPUT"(EX,EY,EZ)",EX,EY,EZ
8240INPUT"(DX,DY,DZ)",DX,DY,DZ
8250PROCtran3(-DX,-DY,-DZ) : PROCmult3
8260FX=EX-DX : FY=EY-DY : FZ=EZ-DZ
8270THETA=FNangle(FX,FY)
8280PROCrot3(-THETA,3) : PROCmult3
8290DIST=SQR(FX*FX+FY*FY)
8300THETA=FNangle(FZ,DIST)
8310PROCrot3(PI-THETA,2) : PROCmult3
8320DIST=SQR(DIST*DIST+FZ*FZ)
8330THETA=FNangle(DIST*FX,-FY*FZ)
8340PROCrot3(THETA,3) : PROCmult3
8350PROCtran3(0,0,DIST) : PROCmult3
8360ENDPROC
8600REM rot3
8610DEF PROCrot3(THETA,AXIS)
8620LOCAL AX1,AX2,CT,ST
8630AX1=(AXIS MOD 3)+1
8640AX2=(AX1 MOD 3)+1
8650CT=COS(THETA) : ST=SIN(THETA)
8660A(AXIS,AXIS)=1 : A(AXIS,AX1)=0 : A(AXIS,AX2)=0
8670A(AX1,AXIS)=0 : A(AX1,AX1)=CT : A(AX1,AX2)=-ST
8680A(AX2,AXIS)=0 : A(AX2,AX1)=ST : A(AX2,AX2)=CT
8690A(1,4)=0 : A(2,4)=0 : A(3,4)=0
8700A(4,1)=0 : A(4,2)=0 : A(4,3)=0 : A(4,4)=1
8710ENDPROC
8800REM angle
8810DEF FNangle(AX,AY)
8820IF ABS(AX)>0.00001 THEN 8860
8830IF ABS(AY)<0.00001 THEN =0
8840IF AY<0 THEN =1.5*PI
8850=PI/2
8860IF AX<0 THEN =(ATN(AY/AX)+PI) ELSE =ATN(AY/AX)
9000REM tran3
9010DEF PROCtran3(TX,TY,TZ)
9020A(1,1)=1 : A(1,2)=0 : A(1,3)=0 : A(1,4)=TX
9030A(2,1)=0 : A(2,2)=1 : A(2,3)=0 : A(2,4)=TY
9040A(3,1)=0 : A(3,2)=0 : A(3,3)=1 : A(3,4)=TZ
9050A(4,1)=0 : A(4,2)=0 : A(4,3)=0 : A(4,4)=1
9060ENDPROC
9100REM mult3
9110DEF PROCmult3
9120LOCAL I%,J%,K%,AR
9130FOR I%=1 TO 4
9140FOR J%=1 TO 4
9150AR=0
9160FOR K%=1 TO 4
9170AR=AR+A(I%,K%)*R(K%,J%)
9180NEXT K%
9190B(I%,J%)=AR
9200NEXT J%
9210NEXT I%
9220FOR I%=1 TO 4
9230FOR J%=1 TO 4
9240R(I%,J%)=B(I%,J%)
9250NEXT J%
9260NEXT I%
9270ENDPROC
9300REM idR3
9310DEF PROCidR3
9320R(1,1)=1 : R(1,2)=0 : R(1,3)=0 : R(1,4)=0
9330R(2,1)=0 : R(2,2)=1 : R(2,3)=0 : R(2,4)=0
9340R(3,1)=0 : R(3,2)=0 : R(3,3)=1 : R(3,4)=0
9350R(4,1)=0 : R(4,2)=0 : R(4,3)=0 : R(4,4)=1
9360ENDPROC
9400REM lineto
9410DEF PROClineto(XPT,YPT)
9420DRAW FNX(XPT),FNY(YPT)
9430ENDPROC
9500REM moveto
9510DEF PROCmoveto(XPT,YPT)
9520MOVE FNX(XPT),FNY(YPT)
9530ENDPROC
9600REM setorigin
9610DEF PROCsetorigin(XMOVE,YMOVE)
9620XORIG=XORIG+XMOVE : YORIG=YORIG+YMOVE
9630PROCmoveto(0,0)
9640ENDPROC
9700REM start
9710DEF PROCstart(B,F)
9720XORIG=0 : YORIG=0
9730NXPIX=1280 : NYPIX=960
9740XYSCALE=NXPIX/HORIZ : YSCALE=NYPIX/VERT
9750IF XYSCALE>YSCALE THEN XYSCALE=YSCALE
9760VDU28,0,1,39,0 : VDU24,0;0;1279;959;
9770GCOL 0,B+128 : CLG : GCOL 0,F
9780ENDPROC
9800REM real-to-pixel functions
9810DEF FNX(Z)=INT((XORIG+Z)*XYSCALE+0.5)
9820DEF FNY(Z)=INT((YORIG+Z)*XYSCALE+0.5)
```

STEREOSCOPIC

I O Angell considers ways of producing perspective projections on screen.

Listing 2.

```
6000REM scene3 / consisting of a cube
6010DEF PROCscene3
6020DIM X(8),Y(8),Z(8),XD(8),YD(8)
6030DIM LIN(2,12),A(4,4),B(4,4),R(4,4)
6040NOV=0 : NOL=0 : PPD=3*VERT
6049REM place CUBE in SETUP position
6050PROCidR3 : PROCobject
6059REM find OBSERVED position.
6060PROCidR3 : PROClook3
6069REM draw the scene
6070PROCdrawit
6079REM repeat
6080GOTO 6060
6090ENDPROC
6500REM object / add to data base
6510DEF PROCobject
6519REM data for a CUBE
6520LOCAL I%,XX,YY,ZZ,L1,L2
6530DATA 1,2, 2,3, 3,4, 4,1, 5,6, 6,7, 7,8, 8,5, 1,5,
2,6, 3,7, 4,8
6540DATA 1,1,1, 1,1,-1, 1,-1,-1, 1,-1,1, -1,1,1, -1,1
,-1, -1,-1,-1, -1,-1,1
6550RESTORE
6559REM store line information.
6560FOR I%=1 TO 12
6570READ L1,L2 : NOL=NOL+1
6580LIN(1,NOL)=L1+NOV : LIN(2,NOL)=L2+NOV
6590NEXT I%
6599REM store vertex information put in position by m
atrix R.
6600FOR I%=1 TO 8
6610READ XX,YY,ZZ : NOV=NOV+1
6620X(NOV)=R(1,1)*XX+R(1,2)*YY+R(1,3)*ZZ+R(1,4)
6630Y(NOV)=R(2,1)*XX+R(2,2)*YY+R(2,3)*ZZ+R(2,4)
6640Z(NOV)=R(3,1)*XX+R(3,2)*YY+R(3,3)*ZZ+R(3,4)
6650NEXT I%
6660ENDPROC
7000REM drawit
7010DEF PROCdrawit
7020LOCAL I%,L1,L2 : CLG
7030FOR I%=1 TO NOV
7039REM put vertices in OBSERVED position, then make
PERSPECTIVE transformation
7040ZZ=R(3,1)*X(I%)+R(3,2)*Y(I%)+R(3,3)*Z(I%)+R(3,4)
7050PMULT=PPD/ZZ
7060XD(I%)=(R(1,1)*X(I%)+R(1,2)*Y(I%)+R(1,3)*Z(I%)+R(
1,4))*PMULT
7070YD(I%)=(R(2,1)*X(I%)+R(2,2)*Y(I%)+R(2,3)*Z(I%)+R(
2,4))*PMULT
7080NEXT I%
7089REM draw lines of scene
7090FOR I%=1 TO NOL
7100L1=LIN(1,I%) : L2=LIN(2,I%)
7110PROCmoveto(XD(L1),YD(L1))
7120PROClineto(XD(L2),YD(L2))
7130NEXT I%
7140ENDPROC
```

Listing 3.

```
6000REMscene3 / consisting of 2 similar objects
6010DEF PROCscene3
6020DIM X(16),Y(16),Z(16),XD(16),YD(16)
6030DIM LIN(2,24),A(4,4),B(4,4),R(4,4)
6040NOV=0 : NOL=0 : PPD=3*VERT
6049REM place first object in SETUP position
6050PROCidR3 : PROCobject
6059REM place second object in a peculiar position
6060PROCidR3
6070PROCrot3(PI/5,1) : PROCmult3
6080PROCrot3(PI/6,2) : PROCmult3
6090PROCtran3(3,2,2) : PROCmult3
6100PROCobject
6109REM specify general rotation
6110PROCidR3 : CLS
6120INPUT"(PX,PY,PZ)",PX,PY,PZ
6130INPUT"(QX,QY,QZ)",QX,QY,QZ
6140INPUT"GAMMA",GAMMA
6150PROCgenrot(PX,PY,PZ,QX,QY,QZ,GAMMA)
6159REM OBSERVED position
6160PROClook3
6169REM draw the scene
6170PROCdrawit
6179REMEOR draw another picture
6180GOTO 6110
6190ENDPROC
```

projections of these points onto the near plane are A^1 and B^1, and onto the far plane A^{11} and B^{11}. Note that the projections will have the same shape and orientation, but they will be of different sizes.

We let the perspective plane be a distance d from the eye — variable PPD in later programs. Consider a point $P=(x,y,z)$ in space which sends a ray into the eye. We must calculate the point where this line cuts the view plane — the $z=d$ plane — suppose it is the point $P^1=(x^1,y^1,d)$. Let us first consider the value of y by referring to figure 2. By similar triangles we see that $y^1/d=y/z$, that is $y^1=y.d/z$. Similarly $x^1=x.d/z$. Hence $P^1=(x.d/z,y.d/z,d)$, and we have the x- and y-co-ordinates of the projection on the screen.

Many of the routines needed to draw a perspective view of an object are the same as those required for the orthographic projection. We lump them all together in the library of routines given in listing 1. It contains the routines Start, Setorigin, Moveto, Lineto and Real-to-pixel functions necessary for manipulating the screen of pixels as though it is a window on real 2-D space.

It also contains routines Angle, Rot3, Tran3, Mult3 and IdR3 for manipulating the matrices that represent transformations of 3-D space as well as Genrot which creates a matrix that represents the rotational transformation of space about a general axis, and Look3 which enables the observer to look from any point (EX,EY,EZ) in space toward any other (DX,DY,DZ).

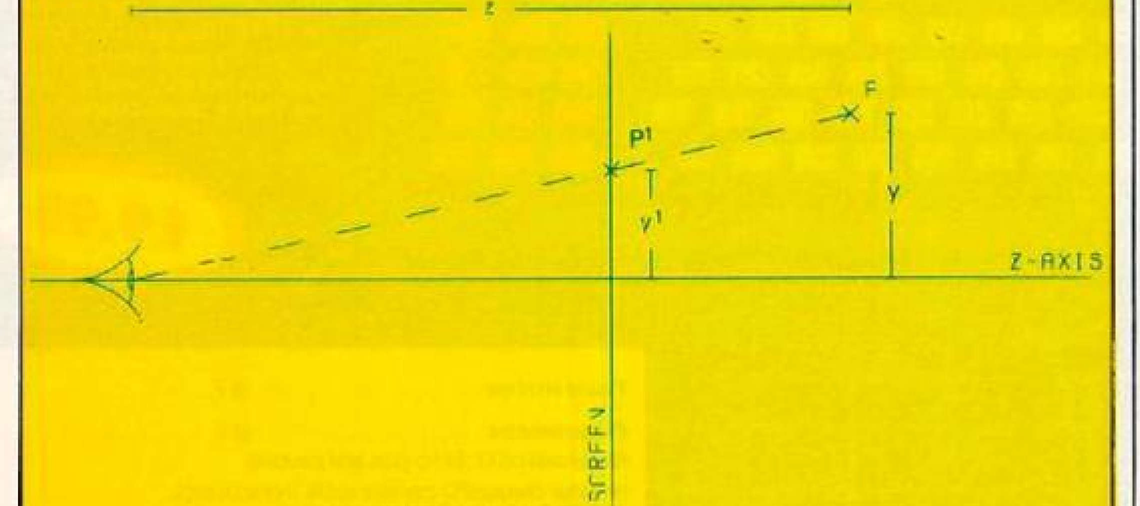


Figure 2.

Use of matrices

If you want to understand them fully you must refer back to my previous article or read *Advanced Graphics with the BBC Model B Microcomputer* by I. O. Angell and E. J. Jones — ISBN 0 333 35052 9.

In order to draw a perspective view we must now create a Scene3 routine which calls other routines to calculate a vertex/line data base describing objects in the scene — the setup positions — uses matrices to move each individual object into its actual position in space, and then again to move space into the observed position where the eye is at the origin looking along the positive z-axis, ready for the perspective projection achieved in the

(continued on page 159)

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Listing 4.

```
6000REM scene3 / a jet
6010DEF PROCscene3
6020DIM X(74),Y(74),Z(74),XD(74),YD(74)
6030DIM LIN(2,92),A(4,4),B(4,4),R(4,4)
6039REM place JET in SETUP position
6040PROCjet
6049REMEORspecify general rotation
6050PROCidRS : CLS
6060INPUT"(PX,PY,PZ)",PX,PY,PZ
6070INPUT"(QX,QY,QZ)",QX,QY,QZ
6080INPUT"GAMMA",GAMMA
6090PROCgenrot(PX,PY,PZ,QX,QY,QZ,GAMMA)
6099REM OBSERVED position
6100PROClook3
6109REM draw the scene
6110PROCdrawit
6119REM repeat
6120GOTO 6050
6130ENDPROC
6500REM jet
6510DEF PROCjet
6520LOCAL I%
6530DATA 0,0,80,  0,0,64,  0,8,32,  4,8,32,  8,4,32,
8,0,32, 4,-4,32,  0,8,-32, 4,8,-32, 8,4,-32, 8,0,-32,
 4,-4,-32,  0,-4,-32,  8,0,24.  48,0,-32,  8,2,-32.
0,8,0,  2.8,-32,  0,32,-32,  28,-4,-24,  30,-2,-24,  3
2, 2, 24,  34, 4,-24
6540DATA 32,-6,-24,  30,-6,-24,  26,-4,8,  30,-2,8.
32,-2,8,  34,-4,8,  32,-6,8,  30,-6,8,  31,0,-24,  31,
-2,-24,  31,-2,-12,  31,0,-12,  0,6,40,  3,6,40
6550DATA 1,2,  2,3,  2,4,  2,5,  2,6,  2,7,  3,4,  4,
9,  5,10,  6,11,  7,12,  8,9,  9,10,  10,11,  11,12,
12,13.  14,15.  15,10,  15,16,  14,16,  17,18,  17,19,
 18,19
6560DATA 20,21,  21,22,  22,23,  23,24,  24,25,  25,2
0,  26,27.  27,28,  28,29,  29.30,  30,31,  31,26,  20
,26,  21,27.  22,28,  23,29,  24,30,  25.31,  32,33,
33,34.  34,35,  35,32,  36,37
6570RESTORE 6530 : NOV=74 : NOL=92
6579REM SETUP vertices and lines for first side ( X>=
0 )
6580FOR I%=1 TO 37 : READ X(I%),Y(I%),Z(I%) : NEXT I%
6590FOR I%=1 TO 46 : READ LIN(1,I%),LIN(2,I%) : NEXT I%
6599REM SETUP vertices and lines for second side ( X<
=0 )
6600RESTORE 6530
6610FOR I%=38 TO 74
6620READ X(I%),Y(I%),Z(I%) : X(I%)=-X(I%)
6630NEXT I%
6640FOR I%=47 TO 92
6650READ L1,L2
6660LIN(1,I%)=37+L1 : LIN(2,I%)=37+L2
6670NEXT I%
6680ENDPROC
7000REM drawit
7010DEF PROCdrawit
7020LOCAL I%,L1,L2 : CLG
7029REM put in OBSERVED position
7030FOR I%=1 TO NOV
7040ZZ=R(3,1)*X(I%)+R(3,2)+Y(I%)+R(3,3)+Z(I%)+R(3,4)
7050PMULT=PPD/ZZ
7060XD(I%)=(R(1,1)+X(I%)+R(1,2)+Y(I%)+R(1,3)*Z(I%)+R(
1,4))*PMULT
7070YD(I%)=(R(2,1)*X(I%)+R(2,2)+Y(I%)+R(2,3)*Z(I%)+R(
2,4))*PMULT
7080NEXT I%
7089REM draw lines of object
7090FOR I%=1 TO NOL
7100L1=LIN(1,I%) : L2=LIN(2,I%)
7110PROCmoveto(XD(L1),YD(L1))
7120PROClineto(XD(L2),YD(L2))
7130NEXT I%
7140ENDPROC
```

(continued from page 157)

Drawit, routine.

The data base will contain information on NOV vertices — their X,Y and Z values and their projected values XD and YD — and NOL lines. The I'th line joins vertices and indicies LIN(1,I) and LIN(2,I).

The only difference between the program which draws a perspective view and that of the orthographic view is in the calculation of the co-ordinates of the projected image on the screen. Unlike the orthographic, in the perspective projection the co-ordinates on the screen cannot be identified with the x- and y-values of the point in observed position. We need to store the perspective transformation of the vertices in the arrays XD and YD so as not to corrupt the data base for future projections. The I'th vertex (X(I),Y(I),Z(I)) in observed position is projected to (XD(I),YD(I)). The values in arrays XD and YD are given by

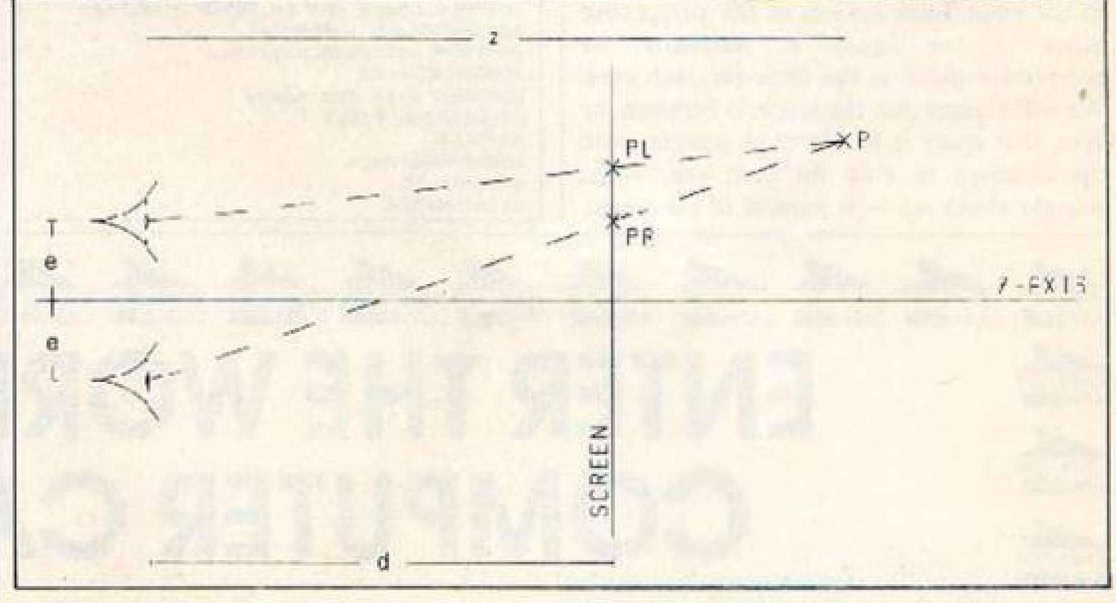
XD(I) = X(I)*PPD/Z(I) and
YD(I) = Y(I)*PPD/Z(I)
for I = 1,2 . . NOV

The value of PPD is set to 3*VERT in Scene3.

We still need to explain our value for PPD. You can see from figure 1 that different values of PPD produce pictures of different sizes — which one do we choose? Is there a correct value. If we consider the practical situation, we note that the observer is sitting in front of a television and the perspective plane is identified with the plane of the T.V. screen. Normally the observer is sitting at a distance which is about three times the height of the screen from the terminal.

In the scale of our mapping from the real-world to the graphics area of pixels, this is a distance 3*VERT. If we choose PPD greater than this value it is as though we are creating a close up, and if PPD is less than 3*VERT we get the smaller image of a long shot.

If you merge listing 2 with listing 1 you get



program 1 which, when run in Mode 4, draws a perspective view of a cube. Try HORIZ = 1, (EX,EY,EZ) = (10,0,0) and (DX,DY,DZ) = (0,0,0). Here we are viewing the wire cube from the front but note that, unlike the orthographic projection, the back face of the cube is smaller in projection than the front face and that lines parallel on the 3-D cube need no longer be parallel in projection: in fact they meet at a vanishing point.

Now choose (EX,EY,EZ)=(20,0,0) ie., the observer is still looking at the cube from the same direction, but from further away: see how the projection is the same shape and orientation as previously but it has diminished in size, as you would expect with perspective! If you now return program 1 with the same values of (EX,EY,EZ) and (DX,DY,DZ) but with HORIZ = 100 you will see that a change in the size of HORIZ makes no difference to the perspective projection! So you can keep a value of HORIZ = 1 for all perspective projections.

Now run the program with (EX,EY,EZ) = (1,0,0). It will fail. The eye of the observer lies in one edge of the cube, and the perspective transformation leads to a division by zero. Theoretically, objects may be positioned throughout space, even behind the eye, however to avoid problems we only consider points with positive z-co-ordinates in the observer position.

Now run program 1 with general values of (EX,EY,EZ) and (DX,DY,DZ) eg., (10,20,30) to (0,0,0) : (5,10,15) to (0,0,0) : (5,10,15) to (1,1,1) etc.

Listing 3 should be merged with listing 1 and the Object and Drawit routines of listing 2, to form program 2 which runs in Mode 4. It gives a general perspective view of a scene consisting of two cubes that can be rotated by an angle Gamma about an axis of rotation which joins point (PX,PY,PZ) to (QX,QY,QZ).

Program 3 is formed by merging listing 4 with listing 1 and the Drawit routine of listing 2. When run in mode 4 it draws a perspective view of a jet. Try HORIZ = 1, (PX,YP,PZ) = (1,1,1), (QX,QY,QZ) = (0,0,0), GAMMA = 1 with (EX,EY,EZ) = (200,300,400) and (DX,DY,DZ) = (0,0,0). Then try (EX,EY,EZ) = (300,400,500) etc.

(continued on next page)

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Perspective views are all very well but we have two eyes. Each eye should have its own perspective view, which will differ slightly from that of the other eye. This is the means by which we appreciate the three-dimensional quality of our world.

This leads to a problem; we cannot simply draw two such projections because the left eye will not only see the view created for it, but also that made for the right eye, and vice versa. To stop this confusion we must ensure that each eye sees its own view, but only its view. This is achieved by using a pair of stereoscopic spectacles: a pair of transparent plastic sheets, one red — left eye — and one blue — right eye. In this way the left eye cannot see red lines because they appear the same colour as the white background.

Similarly for the right eye which cannot see blue lines, but red lines look black. So the computer must make two line drawings of a scene: one in blue for the left eye, and one in red for the right eye: hence we have to run using Mode 1 logically Anding the colours — GCol 2 — onto a white background.

So we wish to devise a method of producing the stereoscopic projection of a general point $P=(x,y,z)$, that is two points $PL=(x_l,y_l)$ for the left eye and $PR=(x_r,y_r)$ for the right eye, in the co-ordinate system of the perspective plane — see figure 3. Naturally the perspective plane is the same for both eyes. We will assume that the origin is between the eyes, that space is in observed position with the direction of view for each eye — the straight ahead ray — is parallel to the z-axis.

Listing 5.

```
7000REM drawit
7010DEF PROCdrawit
7020LOCAL I%,J%,L1,L2 : CLG
7030VDU19,3,4,0,0,0
7040ED=VERT*0.2 : GCOL 2,2
7049REM draw figure twice :- first the view from the right eye then the view from the left eye
7050FOR J%=1 TO 2
7060FOR I%=1 TO NOV
7069REM put vertices in OBSERVED position, then make PERSPECTIVE transformation
7070Z=R(3,1)*X(I%)+R(3,2)*Y(I%)+R(3,3)*Z(I%)+R(3,4)
7080PMULT=PPD/Z
7090XD(I%)=(R(1,1)*X(I%)+R(1,2)*Y(I%)+R(1,3)*Z(I%)+R(1,4)+ED)*PMULT-ED
7100YD(I%)=(R(2,1)*X(I%)+R(2,2)*Y(I%)+R(2,3)*Z(I%)+R(2,4))*PMULT
7110NEXT I%
7119REM draw lines of scene
7120FOR I%=1 TO NOL
7130L1=LIN(1,I%) : L2=LIN(2,I%)
7140PROCmoveto(XD(L1),YD(L1))
7150PROClineto(XD(L2),YD(L2))
7160NEXT I%
7169REM left eye
7170ED=-ED : GCOL 2,1
7180NEXT J%
7190ENDPROC
```

The eyes have co-ordinates $(-e,0,0)$, left, and $(e,0,0)$, right: in the program that follows, e is given by variable ED, which is normally about 0.2*VERT. Again the perspective view plane is a distance d — variable PPD — from the origin. In order to find PL we move space by $(e,0,0)$ so that P becomes $(x+e,y,z)$ and the perspective transform of this point for the left eye is $((x+e).d/z, y.d/z)$, which when we return space to its original position becomes $((x+e).d/z-e, y.d/z)$. Similarly, the right eye transformation produces $PR=((x-e).d/z+e, y.d/z)$.

Listing 6.

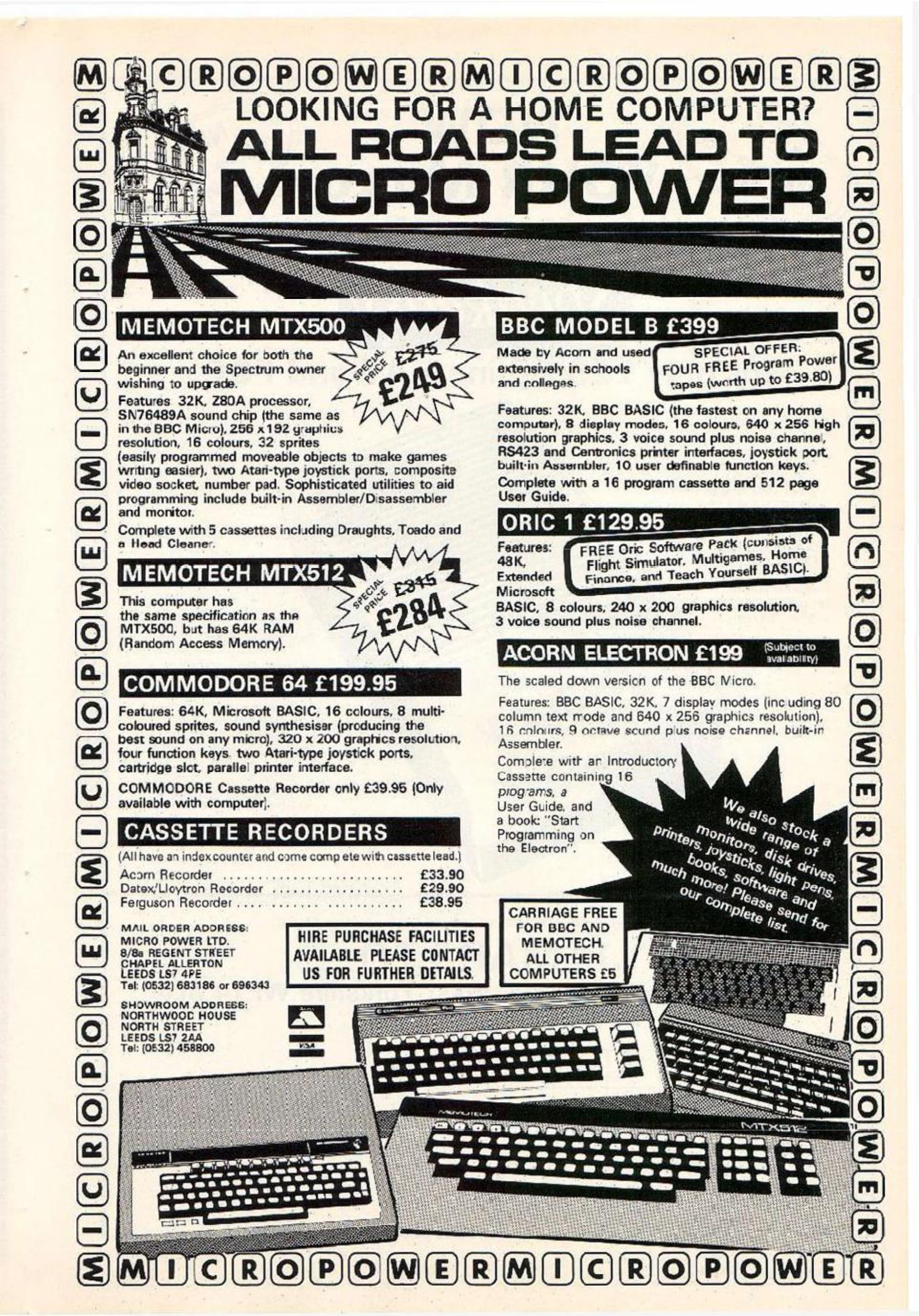
```
6000REM scene3 / a jet
6010DEF PROCscene3
6020DIM X(74),Y(74),Z(74),XD(74),YD(74)
6030DIM LIN(2,92),A(4,4),B(4,4),R(4,4)
6039REM place JET in SETUP position
6040PROCidR3 : PROCjet
6049REM OBSERVED position
6050PROClook3
6059REM draw the scene
6060*SPOOL PICCY
6070CLG
6080PROCdrawit
6090*SPOOL
6100ENDPROC
```

Listing 5 is a Drawit routine which, when used as a replacement in our first two programs, draws a stereoscopic view of the cube — program 1 — or pairs of cubes — program 2.

For the best stereoscopic views it its best to make the perspective plane cut on the object being viewed ie., if $(DX,DY,DX)=(0,0,0)$ then make $\sqrt{(EX^2+EY^2+EZ^2)}=PPD$ (=3*VERT). Therefore in the case of stereoscopic views we cannot keep HORIZ — and VERT — fixed, since for the best projections HORIZ and VERT depends on (EX,EY,EZ). For program 4, formed in the above-mentioned way from program 1, try HORIZ=10, (EX,EY,EZ)=(8,12,16) and (DX,DY,DZ)=(0,0,0).

If you replace the Scene3 of program 3 — the jet — with listing 6, and also use Drawit — listing 5 — you get program 5 for drawing a stereoscopic picture of the jet. There is not enough memory to run the program in mode 1, so instead we run in mode 7, and the program *Spools the picture onto file Piccy in backing store. Then if you clear the old program and *Exec Piccy onto a white mode 1 screen you will get your stereoscopic picture. A good result is achieved with HORIZ=230, (EX,EY,EX)=(250,300,350) and (DX,DY,DZ)=(0,0,0). Type

```
NEW
MODE 1 ; VDU 23 1,0;0;0;0;
GCOL 0,135 : CLG
*EXEC PICCY
```


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John Ransley completes his mini-series on adventure program writing.

ZAGORSK

If you read last month's article and entered the sample program, you will now have spent nearly a month traipsing around the crypts of Zagorsk Monastery looking for that elusive ikon. I promise that it gets more interesting from now on in.

Our sample adventure is based on a grid six squares by six, giving a total 36 possible locations, numbered 1 to 36 — not zero to 35 as shown in last month's feature, for reasons I'll explain later. Each square has the name of the location found at that position, with a notional one-way or two-way arrow or no arrow at all linking it with any adjoining box(es) to indicate possible entrances and exits.

The sample location descriptions and movement data given last month is reflected in lines 7010 to 8415 of the full listing. The eagle-eyed will notice that I have altered slightly legal moves into and out of some locations to make it a little easier for the novice to move around the grid.

You may now enter the complete listing (which should make sense to any micro's dialect of Basic) from start to finish and start playing. But if you want to understand the mechanics of the program, you may prefer to tackle the listing in little chunks or modules, which I'll describe and explain how to test as you go along.

Begin by entering lines 1170, 1180, 1400 to 1450 inclusive and 7010 to 8415 inclusive. As a short cut, you can spare yourself some typing by using just token descriptions — for example, Tsars' Tomb, St Petre — instead of those I've suggested. On the other hand, you may like to start improving on my efforts by expanding on the descriptions to the limits of your imagination.

When you have finished entering all those lines, check your descriptions for awkward line breaks, spelling mistakes and general screen presentation. To do so, simply type Run X, where X is the description's line number, and hit Return. Give special care to entering lines 1400 and 1450. Each of them offers a signpost to one horizontal row of six locations. Here is how they work:

Your current position or CP is set at location 23 — line 1170 — at the start of every new game. That value is then tested by lines 1400 to 1420 in this way. As it is not any of the locations numbered 1 to 18, you drop through lines 1400 to 1420 and come to rest at 1430; CP is less than 25 but not less than 19. Most micros' Basic need a minimum value of 1 for On Goto commands, which is why I dropped the zero when re-numbering the grid.

The program branches

In this particular case, the On Goto routine expects a value from 1 to 6, so 18 is deducted from CP to provide a number in that range. Line 1430 ends its work by counting five places along the queue of description line numbers to arrive at 8170 — and it is to that line number which the program now branches.

You can check that all 36 locations are properly signalled in that way by changing CP to values from 1 to 36 in turn. Do not worry about the error message you will get when Running a test on location 33.

Now we can fill some of those 36 locations with objects — a few of which you will need to overcome challenges and find the ikon. Line 1016 reserves space for three arrays each containing 12 elements — we want to site 12 objects. The numeric array PL% will hold the numbers of the squares where the objects will always be found when a new game begins — their (P)rimary (L)ocations. The first string array, SN$ stores the objects' short names. The second string array, LN$, holds their long names.

On the first pass through the loop in 1022 and 1024, X fills those three arrays with the three data items in line 1030 in turn. The loop repeats the process 11 times. After entering lines 1022 to 1140, test the procedure by typing in direct mode:

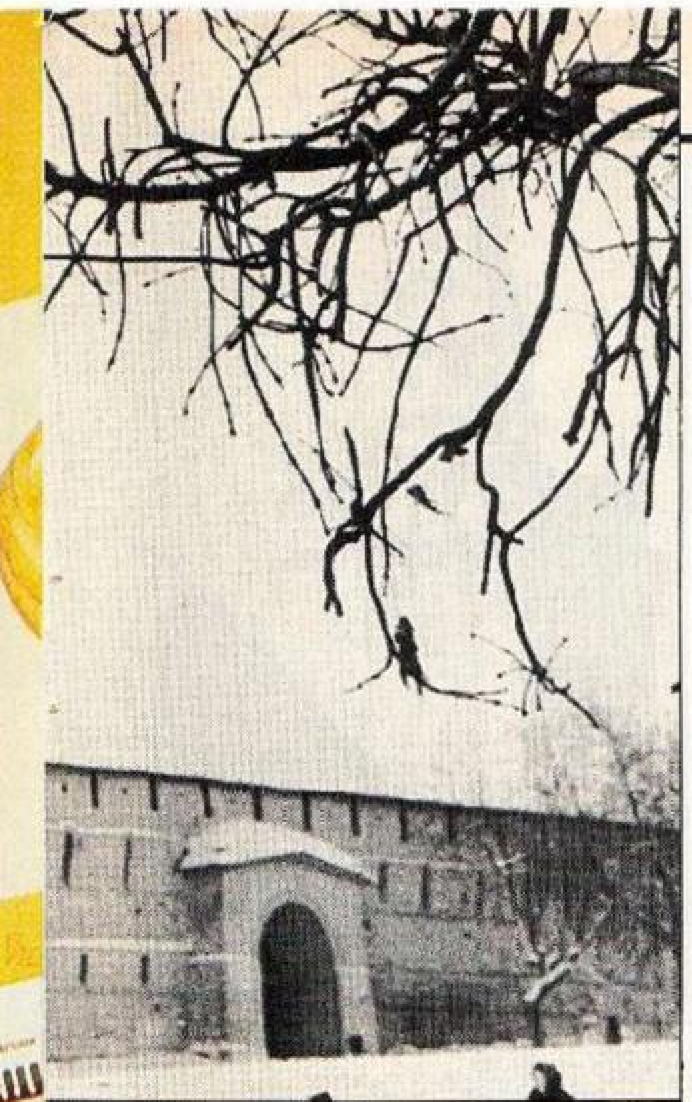
```
PRINT PL%(1):PRINT SN$(1):PRINT LN$(1)
```

This should generate the screen display:

```
2
ROSARY
A BROKEN ROSARY IS HERE
```

You can run through the remaining 11 values of X to check that each three-piece suite of arrays is properly stuffed. We can now say goodbye to the first section by adding line 1150, which awards a token value of 1 to each of the five variables representing hazards you will encounter in the game. A value of 1 indicates they are active challenges; a value of 0 neutralises.

Lines 1620 to 1640 provide the means of



generating a new line of screen text whenever you enter a location that holds an object. It scans each of the 12 grid positions stored in the array PL% for a match with your current position.

Thus if your CP is 2 — the Chapel of the Tsars — on the very first pass through the loop, PL% will equal 2. This condition triggers screen display of the matching LN$0. In short, it will now read:

YOU ENTER THE CHAPEL OF THE TSARS.
A BROKEN ROSARY IS HERE.

Apart from those 12 objects, this adventure also presents five challenges — one of them, the flood water, is found in two adjoining locations. These are the poisoned water at the drinking fountain, a Nazi in the marble hall, the coin lock protecting the ikon in the sealed chamber, the flood water, and darkness in a gloomy chamber. To conquer each challenge, you will need to be carrying a particular object when you encounter it.

We have already given each challenge variable a value of 1 in line 1016. That being so, lines 1680 to 1730 check your current location and the status of any challenge that exists there. Remember that challenges remain in the same location throughout the game — at least until you conquer them — whereas any object can be taken from location to location — and left at one different from that at which it was found.

If a challenge does exist, control passes to line 8440 to 8480 depending on the peril; we will deal with that module later. If no challenge exists, you can move to another location, and lines 1760 to 1810 calculate and display your options. Line 1840 adds some screen space — CHR$(13) is a carriage return — before 1850 invites your response.

The main input routine starts here. You must use the letter N, S, E or W and Return to move. If you try this ploy with an active challenge present, lines 2010 to 2060 speed you off to the wrist-slapping routine in lines 2250 to 2270. Otherwise, line 2110 gives the go-ahead and one of the four possibilities in 2150 to 2180 will act on your choice, calculating your (N)ew (P)osition and looping back to 1200 to update your revised CP.

But say you do not enter N, S, E or W? The instruction I will call your inventory, to show what objects if any you are currently carrying. The H is for help; using it may give you a clue. Press Q if you get thoroughly fed up and want to quit the game.

When you reach a challenge location, you can only survive, escape, find the ikon or whatever by having with you the right object and using the correct command. Lines 2400 to 2435 specify what those commands must be.

Qualifier controls use

The CP qualifier in each line controls their use in the right location but in challenge and any other locations, you may want to try commands of your own. Central to an adventure is the player's freedom to acquire, and perhaps later jettison, the objects he finds along the way. The commands allowing this usually take the form of a two-word sentence comprising one verb and one noun. For example:

TAKE ROPE
GET CANDLES
DROP ROSARY
LEAVE SCROLL

Lines 2460 to 2840 walk through each such command, searching for the space which separates the two. If one cannot be found — suggesting that one word, not two, has been entered — control passes to line 2490. Otherwise, lines 2530 to 2570 get to work on splitting the two-word command into a verb string and noun string, naming the word to the left of the space VE$ and that to the right NO$.

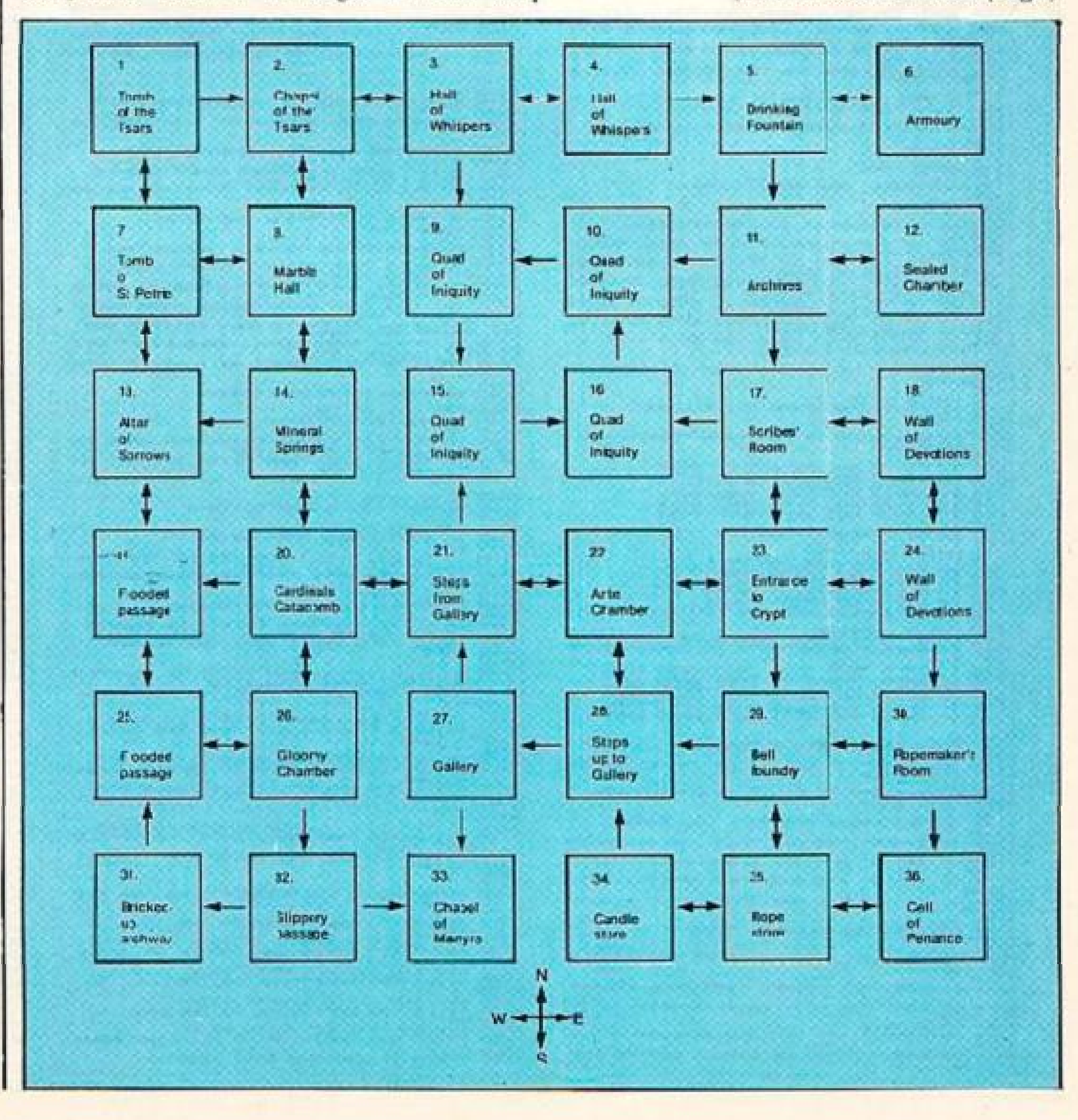
Lines 2600 to 2630 then check VE$ for verbs recognised. You can have any number you like up to your micro's maximum line length, and even then you can always spill over into additional lines. For example, you could add STEAL, GRAB or PICK; DUMP, ABANDON or LOSE: and SLAY, CONQUER or SHOOT as additions to lines 2600, 2610 and 2620 respectively. Line 2650 takes care of any verb outside the VE$ dictionary.

When you Take or Get any object — or dispose of it — you'll want the Inventory to reflect that fact. The routine contained within lines 2670 to 2720 does that for you. Likewise, any call for help will pass control to lines 2750 to 2800, to display any clue available in respect of your current location.

The Get and Drop functions are probably the most important in any adventure program and although you are welcome to adopt unquestioningly the routines in lines 2830 to 2890 and 3020 to 3070 respectively, you will find that they repay a little study.

Line 2830 sets up a (G)et loop which will check out the 12 possible objects; line 2840 actually makes the comparison between the object(s) found at your current position and the object you want to take. If there is a match then that location is given a negative value (−1) only in respect of the object you now carry. It is safe to use −1 because it is a distinctive value — often used, for example, to signal the end of a Data queue — which

(continued on next page)



Variables.			
PL	Primary location.	S	South.
SN$	Short name string.	E	East.
LN$	Long name string.	W	West.
PW	Poisoned water.	I$	Instructions input string.
NZ	Nazi.	I	Inventory.
CL	Coin lock.	H	Help.
FW	Floodwater.	Q	Quit.
DK	Darkness.	SP	Space between noun and verb.
CP	Current position.	VE$	Verb string.
N	North.	NO$	Noun string.

(continued from previous page)

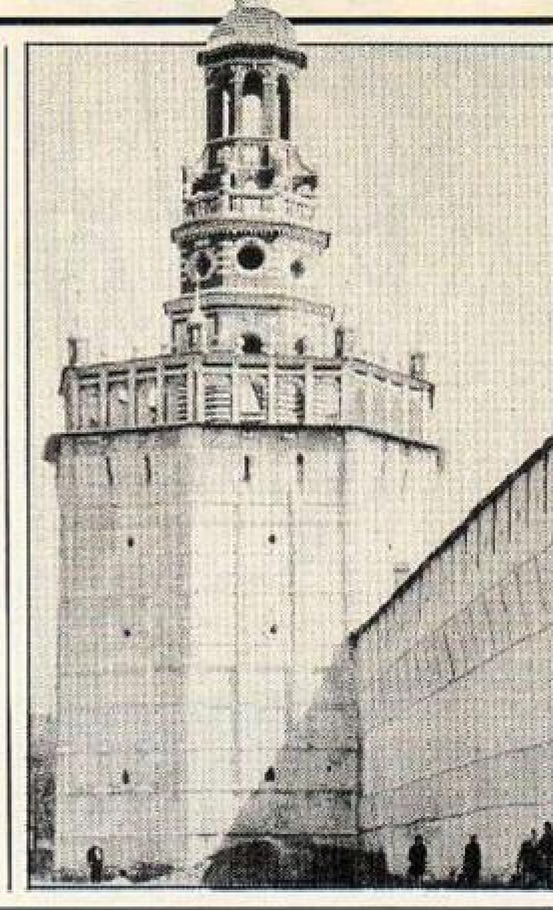
cannot be confused with any other variable.

If the location is one where a −1 flag already exists in respect of the object you wish to take, then it means you carry it already, and line 2860 announces the fact. Or if you try to Get an object that is not at that location anyway, line 2870 does its bits. Otherwise, 2890 will confirm your selection. Enter I and Return now and you will see that your inventory has been appropriately updated.

Lines 3020 to 3075 perform the same function in reverse in response to Drop or Leave, testing in line 3050 for a value other than −1.

You will remember that your success in overcoming any and all of the five special challenge depends on being in possession of the right objects at the right locations and using them properly. Lines 5010 to 5200 monitor the relevance of the objects you carry to the location you have reached.

If you do well, then the matching status flag — PW=1, NZ=1 and so on — is neutralised with a value of 0 and you are allowed to move on. Neutralising the challenge also means that you are allowed to move on. Neutralising the challenge also means that you will not encounter it again if you return to that same location later. If you fail, you will either find yourself trapped or despatched to the play again routine in lines 9005 to 9060.



```
1000 REM*****THE ST PETERSBURG ICON ****
*
1002 '
1003 REM***WRITTEN FOR YOUR COMPUTER***
1004 '
1005 REM***COPYRIGHT 1984 JOHN RINGLEY**
*
1006 '
1014 REM***SET UP OBJECT ARRAYS***
1015 '
1016 DIM PL%(12),SN$(12),LN$(12)
1017 '
1018 REM***FILL OBJECT ARRAYS***
1020 '
1022 FOR X=1TO12:READ PL%(X),SN$(X),LN$(
X):
1024 NEXT
1025 '
1026 REM***DATA FOR OBJECT ARRAYS***
1028 '
1030 DATA 2,ROSARY,A BROKEN ROSARY IS HE
RE.
1040 DATA 6,CAP,YOU FIND A BRITISH OFFIC
ER'S CAP.
1050 DATA 11,SCROLL,AN ILLUMINATED SCROL
L IS HERE.
1060 DATA 13,DAGGER,A NAZI DAGGER IS AT
YOUR FEET.
1070 DATA 17,PRAYER BOOK,YOU NOTICE AN O
PEN PRAYER BOOK.
1080 DATA 18,COINS,A FEW COINS ARE SCATT
ERED AROUND.
1090 DATA 20,ELIXIR,A BOTTLE OF HERBAL E
LIXIR IS HERE.
1100 DATA 27,KEYS,YOU DISCOVER AN OLD BU
NCH OF KEYS.
1115 DATA 29,TOOLS,SOME OLD TOOLS ARE WI
THIN REACH
1120 DATA 31,CIGAR LABEL,YOU SPOT A DUTC
H CIGAR LABEL
1130 DATA 34,CANDLES,A FEW UNUSED CANDLE
S REMAIN HERE
1140 DATA 35,ROPE,YOU NOTICE SOME OLD LE
NGTHS OF ROPE
1142 '
1145 REM***SET STATUS OF CHALLENGES***
1150 PW=1:NZ=1:CL=1:FW=1:DK=1
1155 '
1160 REM***SET CURRENT POSITION***
1165 '
1170 CP=23
1175 '
1180 GOTO 1400
1185 '
1190 REM***SET NEW POSITION***
1195 '
1200 CP=NP
1210 '
1220 REM***SIGNPOST TO LOCATION***
1230 '
1400 IF CP<7 THEN ON CP GOTO 7010,7020,7
030,7040,7050,7060
1410 IF CP<13 THEN ON CP-6 GOTO 8010,802
0,8030,8040,8050,8060
1420 IF CP<19 THEN ON CP-12 GOTO 8070,80
80,8090,8100,8110,8120
1430 IF CP<25 THEN ON CP-18 GOTO 8130,81
40,8150,8160,8170,8180
1440 IF CP<31 THEN ON CP-24 GOTO 8200,82
20,8230,8240,8250,8300
1450 IF CP<37 THEN ON CP-30 GOTO 8320,83
30,8380,8390,8390,8410
1600 '
1605 REM***PRINT OBJECT HAVE IN RIGHT LO
CATION***
1610 '
1620 FOR X=1 TO 12
1630 IF PL%(X)=CP THEN PRINT LN$(X)
1640 NEXT
1650 '
1670 REM***CHECK IF LOCATION PRESENTS A
CHALLENGE***
1675 '
1680 IF CP= 5 AND PW=1 THEN 8440
1690 IF CP= 6 AND NZ=1 THEN 8450
1700 IF CP=12 AND CL=1 THEN 8460
1710 IF CP=19 AND FW=1 THEN 8470
1720 IF CP=25 AND FW=1 THEN 8470
1730 IF CP=26 AND DK=1 THEN 8480
1740 '
1750 REM***DISPLAY POSSIBLE MOVES***
1755 '
1760 PRINT CHR$(12)
1770 PRINT "YOU MAY NOW MOVE ";
1780 IF N>0 THEN PRINT "NORTH ";
1790 IF S>0 THEN PRINT "SOUTH ";
1800 IF E>0 THEN PRINT "EAST ";
1810 IF W>0 THEN PRINT "WEST"
1830 REM***INVITE NEW INSTRUCTION***
1835 '
1840 PRINT CHR$(12)
1850 PRINT"WHAT NOW?":INPUT I$
2000 REM****REM BLOCK MOVE IF CHALLENGE E
XISTS***
2010 IF CP=5  AND PW=1 THEN GOTO 2250
2020 IF CP=6  AND NZ=1 THEN GOTO 2250
2030 IF CP=12 AND CL=1 THEN GOTO 2250
2040 IF CP=19 AND FW=1 THEN GOTO 2250
2050 IF CP=25 AND FW=1 THEN GOTO 2250
2060 IF CP=26 AND DK=1 THEN GOTO 2250
2070 '
2080 '
2090 REM***CHECK KEY ENTERED***
2100 '
2110 IF I$="N" OR I$="S" OR I$="E" OR I$
="W" THEN 2150
2115 '
2120 REM***JUMP TO OTHER I$ OPTIONS***
2130 GOTO 2320
2135 '
2140 REM***CHANGE POSITION VALUE***
2145 '
2150 IF I$="N" AND N>0 THEN NP=CP-6:GOTO
 1200
2160 IF I$="S" AND S>0 THEN NP=CP+6:GOTO
 1200
2170 IF I$="E" AND E>0 THEN NP=CP+1:GOTO
 1200
2180 IF I$="W" AND W>0 THEN NP=CP-1:GOTO
 1200
2190 '
2200 REM***BLOCK ILLEGAL MOVE IF N,S,E O
R W = 0***
2210 '
2220 PRINT "YOU CAN'T.":PRINT CHR$(13):G
OTO 1200
2230 '
2240 REM****BLOCK ESCAPE FROM CHALLENGE**
*
2250 IF I$="N"ORI$="S"ORI$="E"ORI$="W"TH
EN 2270
2260 GOTO 2320
2270 PRINT"NOT YET YOU DON'T!":GOTO 1840
2300 '
2310 REM***CHECK OTHER SINGLE LETTER INP
UTS***
2315 '
2320 IF I$="I" THEN 2670
2330 IF I$="H" THEN 2750
2340 IF I$="Q" THEN 9005
2345 '
2350 '
2355 REM***CHECK FOR SPECIAL COMMANDS***
2360 '
2400 IF I$="SWALLOW ELIXIR" AND CP=5 THE
N 5010
2410 IF I$="STRANGLE NAZI" AND CP=6 THEN
 5030
2420 IF I$="INSERT COINS" AND CP=12 THEN
 5050
2430 IF I$="SWIM WATER" AND CP=19 OR CP=
25 THEN 5070
2435 IF I$="LIGHT CANDLES" AND CP=26 THE
N 5090
2440 '
2450 REM***SCAN TWO-WORD COMMANDS***
2455 '
2460 FOR N=1 TO LEN(I$)
2470 IF MID$(I$,N,1) = " " THEN 2530
2480 NEXT N
2490 PRINT"YOU MUST USE TWO WORDS":GOTO
1840
2500 '
2510 REM***SPLIT VERB AND NOUN***
2520 '
2530 FOR SP=1 TO LEN(I$)
2540 IF MID$(I$,SP,1) = " " THEN 2560
2550 NEXT SP
2560 VE$ = LEFT$(I$,SP-1)
2570 NO$ = RIGHT$(I$,LEN(I$)-SP)
2580 '
2590 REM***SCAN VE$ FOR RECOGNISED COMMA
NDS***
2595 '
2600 IF VE$="GET" OR VE$="TAKE" THEN 283
0
2610 IF VE$="DROP" OR VE$="LEAVE" THEN 3
020
2630 '
2640 REM***IF VERB NOT RECOGNISED***
2645 '
2650 PRINT"SORRY, YOU CAN'T ";I$:GOTO 18
40
2655 '
2660 REM***MAKING THE INVENTORY***
2665 '
2670 PRINT"YOUR INVENTORY COMPRISES -"
2680 IN=0:FOR L=1 TO 12
2690 IF PL%(L) = -1 THEN PRINT SN$(L):IN
=IN+1
2700 NEXT
2710 IF IN=0 THEN PRINT "NOTHING"
2720 GOTO 1750
2730 '
2735 REM***RESPOND TO HELP REQUEST***
2740 '
2750 IF CP=5 THEN PRINT "NOUGHT ELSE TO
DRINK?":GOTO 1840
2760 IF CP=12 THEN PRINT"CHANGE IN THE S
ITUATION?":GOTO 1840
2770 IF CP=6 THEN PRINT"LOOSE FROM THE F
RONT?":GOTO 1840
2780 IF CP=19 OR CP=25 THEN PRINT"A BAD
WORKMAN?":GOTO 1840
2790 IF CP=26 THEN PRINT "SOME LIGHT MIG
HT HELP.":GOTO 1840
2800 PRINT"SORRY - CAN'T HELP YOU.":GOTO
 1840
2810 '
2820 REM***GETTING OBJECTS***
2825 '
2830 FOR O=1 TO 12
2840 IF SN$(O)=NO$ THEN 2860
2850 NEXT
2860 IF PL%(O)=-1 THEN PRINT"YOU HAVE "S
N$(O)" ALREADY.":GOTO 1750
2870 IF PL%(O)<>CP THEN PRINT SN$(O)" NO
T HERE.":GOTO 1750
2880 PRINT"YOU'VE TAKEN ";SN$(O):PL%(O)=
-1
2890 GOTO 1750
3000 REM***DROPPING OBJECTS***
3010 '
3020 FOR L=1 TO 12
3030 IF SN$(L)=NO$ THEN 3050
3040 NEXT
3050 IF PL%(L) <> -1 THEN PRINT "YOU DON
'T HAVE "SN$(L):GOTO 1750
3060 PRINT"YOU HAVE DROPPED ";SN$(L):PL%
(L)=CP
3070 GOTO 1750
5000 REM***CHALLENGE ROUTINES***
5005 '
5010 IF PL%(7)=-1 THEN PRINT"THE ELIXIR
WORKS.":PW=0:GOTO 1750
5020 PRINT "YOU DON'T HAVE THE ELIXIR.":
GOTO 9005
5025 '
5030 IF PL%(12)=-1 THEN PRINT"HE SLUMPS
UNCONSCIOUS.":NZ=0:GOTO 1750
5040 PRINT "YOU DON'T HAVE THE ROPE":GOT
O 9005
5045 '
5050 IF PL%(6)=-1 THEN CL=0:GOTO 8510
5060 PRINT"BUT YOU DON'T HAVE THE COINS.
":GOTO 1840
5065 '
5070 IF PL%(9)=-1 THEN 5090
5075 PRINT"YOU HAVE SWUM TO SAFETY.":FW=
0:GOTO 1750
5090 PRINT"THE WEIGHT OF THE TOOLS DRAGS"
5091 PRINT"YOU UNDER AND YOU DROWN!":GOT
O 9005
5095 '
5096 IF PL%(11)<>-1 THEN [illegible]
5100 PRINT"BUT YOU DON'T HAVE THE CANDLE
S.":GOTO 1840
5200 PRINT"YOU CAN SEE AHEAD NOW.":DK=0:
GOTO 1750
6000 '
6990 '
7000 REM***LOCATION DESCRIPTIONS AND EXI
T ROUTINES***
7005 '
7010 PRINT"YOU HAVE REACHED THE TOMB OF
THE TSARS."
7015 N=0:S=7:E=2:W=0:GOTO 1620
7020 PRINT"YOU ENTER THE CHAPEL OF THE T
SARS."
7025 N=0:S=8:E=3:W=0:GOTO 1620
7030 PRINT"YOU HAVE COME TO THE HALL OF
WHISPERS."
7035 N=0:S=9:E=4:W=2:GOTO 1620
7040 PRINT"YOU HAVE COME TO THE HALL OF
WHISPERS."
7045 N=0:S=0:E=5:W=3:GOTO 1620
7050 PRINT"YOU ARRIVE AT A DRINKING FOUN
TAIN."
7055 N=0:S=11:E=6:W=0:GOTO 1620
7060 PRINT"HERE IS EVIDENCE OF AN OLD ARMOURY."
7065 N=0:S=0:E=0:W=5:GOTO 1620
8010 PRINT"HERE IS THE SILENT TOMB OF ST. PETRIS."
8015 N=1:S=13:E=0:W=0:GOTO 1620
8020 PRINT"YOU WANDER INTO A VAST MARBLE HALL."
8025 N=2:S=14:E=0:W=7:GOTO 1620
8030 PRINT"YOU TREAD THE QUAY OF INIQUITY."
8035 N=0:S=15:E=0:W=0:GOTO 1620
8040 PRINT"YOU TREAD THE QUAY OF INIQUITY."
8045 N=0:S=0:E=0:W=0:GOTO 1620
8050 PRINT"DUST-DRAPED ARCHIVES LIE BEFORE YOU."
8055 N=5:S=17:E=11:W=10:GOTO 1620
8060 PRINT"YOU STAND BEFORE A SEALED CHAMBER."
8065 N=0:S=0:E=0:W=11:GOTO 1620
8070 PRINT"YOU PAUSE AT THE ALTAR OF SORROWS."
8075 N=7:S=19:E=0:W=0:GOTO 1620
8080 PRINT"THE CRYSTAL WATERS OF A MINERAL"
8081 PRINT"SPRING BUBBLE FROM THE GROUND."
8085 N=8:S=20:E=0:W=13:GOTO 1620
8090 PRINT"YOU TREAD THE QUAY OF INIQUITY."
8095 N=0:S=0:E=16:W=0:GOTO 1620
8100 PRINT"YOU TREAD THE QUAY OF INIQUITY."
8105 N=10:S=0:E=0:W=0:GOTO 1620
8110 PRINT"YOU ARRIVE IN A DESERTED SCRIBES' ROOM."
8115 N=11:S=23:E=18:W=16:GOTO 1620
8120 PRINT"YOU WALK ALONG THE WALL OF DEVOTIONS."
8125 N=0:S=24:E=0:W=17:GOTO 1620
8130 PRINT"A FLOODED PASSAGE LIES BEFORE YOU."
8135 N=13:S=25:E=0:W=0:GOTO 1620
8140 PRINT"THE [illegible] LOOMS JUST AHEAD."
8145 N=14:S=26:E=21:W=19:GOTO 1620
8150 PRINT"YOU SEE STEPS DOWN FROM THE GALLERY."
8155 N=15:S=0:E=22:W=20:GOTO 1620
8160 PRINT"YOU ENTER A TINY ANTE-CHAMBER."
8165 N=0:S=28:E=23:W=21:GOTO 1620
8170 PRINT"YOU ARE NOW AT THE ENTRANCE TO THE"
8171 PRINT"CRYPTS OF ZAGORSK MONASTERY."
8175 N=17:S=29:E=24:W=22:GOTO 1620
8180 PRINT"YOU WALK ALONG THE WALL OF DEVOTIONS."
8185 N=18:S=30:E=0:W=23:GOTO 1620
8200 PRINT"A FLOODED PASSAGE LIES BEFORE YOU."
8210 N=19:S=0:E=26:W=0:GOTO 1620
8220 PRINT"YOU STUMBLE INTO A GLOOMY CHAMBER."
8225 N=20:S=32:E=0:W=25:GOTO 1620
8230 PRINT"FROM THIS GALLERY, YOU CAN ONLY SEE"
8231 PRINT"TWO FLIGHTS OF STONE STEPS."
8235 N=21:S=33:E=0:W=0:GOTO 1620
8240 PRINT"YOU GLIMPSE STEPS LEADING TO A GALLERY."
8245 N=22:S=0:E=0:W=27:GOTO 1620
8250 PRINT"YOU ENTER A DISUSED BELL FOUNDRY."
8255 N=0:S=35:E=20:W=29:GOTO 1620
8300 PRINT"BELL ROPES WERE ONCE MADE IN THIS ROOM."
8305 N=0:S=36:E=0:W=29:GOTO 1620
8320 PRINT"A BRICKED-UP ARCHWAY COMES INTO VIEW."
8325 N=25:S=0:E=0:W=0:GOTO 1620
8330 PRINT"THE GROUND IS SLIPPERY HERE."
8335 N=0:S=0:E=33:W=31:GOTO 1620
8340
8345 REM***SPECIAL PERIL ROUTINE***
8350
8360 PRINT"A BAD CHOICE...YOU'VE TRESPASSED INTO"
8361 PRINT"THE CHAPEL OF MARTYRS, WHERE SCREAMING"
8362 PRINT"[illegible] YOUR FLESH"
8363 PRINT"WITH THE RED-HOT SPIKES UPON WHICH"
8364 PRINT"THEY WERE IMPALED WHEN EXECUTED."
8365
8366 REM***DROP OUT OF PROGRAM***
8367
8368 GOTO 9005
8370
8380 PRINT"THIS PLACE IS JUST THE CANDLE STORE."
8385 N=28:S=0:E=35:W=0:GOTO 1620
8390 PRINT"THIS IS THE SITE OF THE OLD ROPE STORE."
8400 N=29:S=0:E=36:W=34:GOTO 1620
8410 PRINT"YOU ENTER THE TINY CELL OF PENANCE."
8415 N=0:S=0:E=0:W=35:GOTO 1620
8420 '
8425 REM***PRINT APPROPRIATE CHALLENGE***
8430 '
8440 PRINT"ALAS! - YOU DRINK SOME POISONED WATER!":GOTO 1840
8450 PRINT"YOUR DANGEROUS NAZI ADVERSARY POUNCES!!!":GOTO 1840
8460 PRINT"IT HAS A STEEL DOOR WITH A CURIOUS SLOT.":GOTO 1840
8470 PRINT"THE WATER IS TOO DEEP TO PASS ON FOOT.":GOTO 1840
8480 PRINT"IT IS TOO DARK TO SEE ANYTHING.":GOTO 1840
8490 '
8500 REM***SUCCESS ROUTINE***          8505
8510 PRINT"CONGRATULATIONS!!! YOU HAVE OPENED"
8520 PRINT"THE CHAMBER AND THE ICON'S"
8530 PRINT"PRICELESS BEAUTY MEETS YOUR GAZE."
8540 PRINT"NOW TO FIND YOUR WAY BACK"
8550 PRINT"SAFELY TO THE CRYPT'S ENTRANCE!":GOTO 1750
8560
9000 REM***WRAP-UP ROUTINE***
9005 PRINT CHR$(13)
9010 PRINT"YOU HAVE REACHED THE END OF THIS"
9020 PRINT"ATTEMPT TO FIND THE ST PETERSBURG ICON."
9030 PRINT"WOULD YOU LIKE ANOTHER TRY?"
9040 INPUT I$
9050 IF I$ = "Y" THEN 1150
9060 END

READY.
```

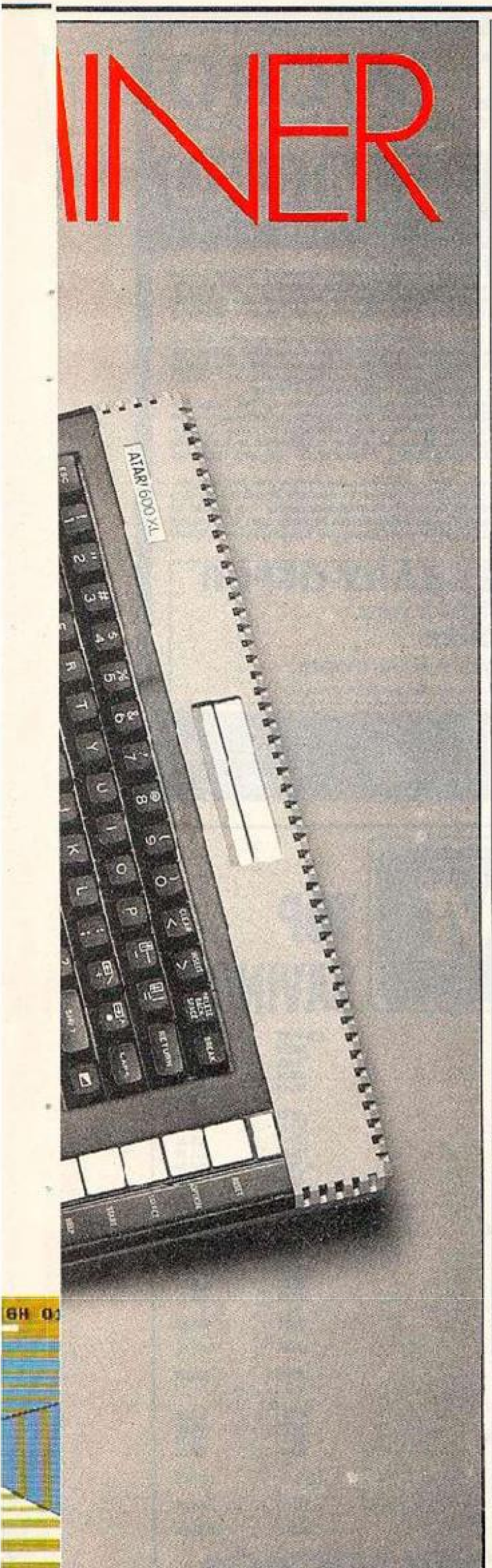
MONSTER M

Frederick Shotton shows you how to be a monster mining mercenary with the help of an Atari.



```
0 POKE 559,0:GOSUB 20000
1 REM ...BY FREDERICK SHOTTON
3 REM ........................
4 REM ...19 WEIDELAAN
5 REM ...1980 ZEKVAREN
6 REM .....BELGIUM
8 SOUND 0,255,10,8
9 SOUND 1,254,10,8
10 GRAPHICS 1+16
20 POKE 712,0:POKE 708,52
30 POSITION 3,3:? #6;"MONSTER MINER":P
OSITION 2,4:? #6;"----------------"
40 POSITION 1,5:? #6;"BY FRED SHOTTON"
49 REM CHANGE CHARACTER SET
50 GOSUB 20000
55 POSITION 1,5:? #6;"
                 "
60 POSITION 1,7:? #6;" # =1":? #6:? #6
;" $ =500":? #6:? #6;" [ =750":? #6:
? #6;" \ =1 LIFE"
70 ? #6:? #6;" ] =+50 OXYGEN"
100 POKE 712,240
101 REM LOAD PLAYER MISSILE SUBROUTINE
102 GOSUB 25000:FOR I=0 TO 3:SOUND I,0
,0,0:NEXT I:POKE 752,180:POKE 711,255:
REM
103 REM MOST VARIABLES USED IN PROGRAM
104 SC=0:L=3
105 X0=80:Y0=73:X1=103:Y1=159:X2=167:Y
2=63:X3=176:Y3=150:E=1:W=1:Q=1:6=0:SOU
ND 0,0,0,0:SOUND 1,0,0,0
106 A=USR(256)
107 XX=9:YY=10:EA=0:V0=8:V2=11:V3=10:V
1=V0-1:V2=V2+1:V3=V3+1:AL0=0:AL1=0:AL2
=0:AL3=0:OX=230:POKE 712,214
108 FOR I=0 TO 3:POKE 53256+I,0:NEXT I
109 REM SET UP SCREEN
110 POKE 708,226:COLOR ASC(CHAR$(5)):F
OR I=0 TO 19:FOR Y=2 TO 19:PLOT I,Y:NE
XT Y:NEXT I:POKE 708,32
120 COLOR 0:PLOT 8,10:DRAWTO 10,10:PLO
T 5,5:DRAWTO 5,7:PLOT 6,16:DRAWTO 6,16
:PLOT 14,4:DRAWTO 16,4:PLOT 16,14:DRAW
TO 16,16
121 REM .......................
122 REM SET MONSTER POSITIONS
123 REM .......................
125 POKE 710,255
126 POKE 77,0
130 POKE PLX,X0:POKE PLY,Y0:POKE PLX+1
,X1:POKE PLY+1,Y1:POKE PLX+2,X2:POKE P
LY+2,Y2:POKE PLX+3,X3:POKE PLY+3,Y3
140 COLOR ASC(CHAR$(1))+128:PLOT X,Y
150 GOTO 1000
297 REM .......................
298 REM MOVE MINER
299 REM .......................
300 YE=1:GOSUB 4000:YE=0:COLOR ASC(CHA
R$(1))+128:PLOT XX,YY:RETURN
310 YE=1:GOSUB 4000:YE=0:COLOR ASC(CHA
R$(2))+128:PLOT XX,YY:RETURN
320 YE=1:GOSUB 4000:YE=0:COLOR ASC(CHA
R$(3))+128:PLOT XX,YY:RETURN
330 YE=1:GOSUB 4000:YE=0:COLOR ASC(CHA
R$(4))+128:PLOT XX,YY:RETURN
400 FOR I=1 TO 255:SOUND 0,I,2,15:POK
E 710,I:NEXT I
410 L=L-1:IF L<=0 THEN 450
411 SOUND 0,0,0,0
420 COLOR 0:PLOT XX,YY:XX=9:YY=10:RETU
RN
449 REM .....GAME OVER......
450 POSITION 0,19:? #6;"GAME OVER":SC=
0:L=3:SOUND 0,0,0,0
460 IF STRIG(0)=1 THEN 460
470 GOTO 104
499 REM NO MORE OXYGEN
500 L=L-1:POSITION 0,23:? #6;"NO OXYGE
N";"  ":POKE 710,0:FOR I=1 TO 500:NEXT
 I
505 FOR I=1 TO 200:SOUND 0,1,2,15:NEX
T I
510 COLOR 0:PLOT XX,YY:GOTO 105
999 REM MAIN LOOP
1000 ST=STICK(0)
1010 SOUND 0,100,12,2
1100 IF ST=14 AND YY>1 THEN COLOR 0:PL
OT XX,YY:YY=YY-1:GOSUB 320
1200 IF ST=13 AND YY<19 THEN COLOR 0:P
LOT XX,YY:YY=YY+1:GOSUB 330
1300 IF ST=7 AND XX<19 THEN COLOR 0:PL
OT XX,YY:XX=XX+1:GOSUB 310
1400 IF ST=11 AND XX>0 THEN COLOR 0:PL
OT XX,YY:XX=XX-1:GOSUB 300
1999 REM DISPLAY INFORMATION
2000 POSITION 0,20:? #6;"SCORE=";SC;"
   ":POSITION 9,22:? #6;"LIVES=";L;"
"
2010 POSITION 0,23:? #6;"OXYGEN=";OX;"
  "
2050 SOUND 0,200,12,6
2070 IF OX<=0 THEN GOSUB 500
2080 IF L<=0 THEN 450
3000 IF STRIG(0)<>0 THEN 4000
3005 REM SHOOT....
3100 IF STICK(0)<>14 OR YY<2 THEN 3200
3110 COLOR ASC(CHAR$(12))+128:PLOT XX,
YY-1:PLOT XX,YY-2:GOSUB 3900
3111 FOR I=1 TO 100:SOUND 0,I,6,.5:NEX
T I
3115 FOR I=1 TO 100:NEXT I:COLOR 0:PLO
T XX,YY-1:PLOT XX,YY-2:GOTO 3998
3200 IF STICK(0)<>13 OR YY>17 THEN 330
0
3210 COLOR ASC(CHAR$(12))+128:PLOT XX,
YY+1:PLOT XX,YY+2:GOSUB 3900
3211 FOR I=1 TO 100:SOUND 0,I,6,.5:NEX
T I
3215 FOR I=1 TO 100:NEXT I:COLOR 0:PLO
T XX,YY+1:PLOT XX,YY+2:GOTO 3998
```

(listing continued on opposite page)



ONCE AGAIN YOU have been hired to kill off monsters in the deep caverns of Mars. National Martian Mining Industries has hired you in the hope of killing these monsters once and for all. No one has ever come back from there. Luckily, a new weapon that is able to destroy these monsters has just been invented. One problem remains though — only small amounts of oxygen can be carried at one time so you will have to collect the old oxygen tanks left behind by other adventurers.

You must however, be quick for they disappear after a while. From time to time, a strawberry or cherry will appear. If you decide to collect them you will get bonus points. If you wait too long though, they will go bad and will be no longer edible.

If you are not a very experienced programmer, you might want to skip this section and copy the program. Monster Miner uses two interrupts; the first one, a Vertical Blank Interrupt, moves the player missile objects. If you want more information on that interrupt, refer to articls on the subject in past issues of *Your Computer* or buy one of the numerous books on sale describing this.

The other nterrupt plays a background tune while you are playing the game. The operating system of your computer supports five of these general purpose software timers. I used the first one. This timer counts backwards from a non-zero value to zero.

Upon reaching zero, the operating system does an indirect JSR through a RAM vector.

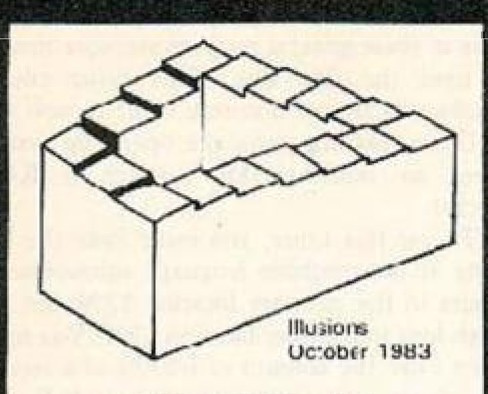
To use this timer, you must Poke the low byte of the machine language subroutine of yours in the memory location $225 and the high byte in memory location $227. You must then Poke the amount of 1/60ths of a second you want you computer to wait before it executes your subroutine in location $218. In your subroutine, you must include another Poke with the amount of 1/60ths of a second or the subroutine will not execute a second time.

The game also redefines the character set. That is why it takes so long for the program to start.

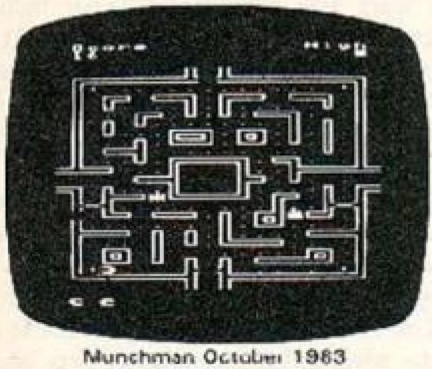
By the way, this program requires at least 24K to run. If you have not got time to copy in the program or you are not very good at typing, you can always send a blank cassette, £3 and a self addressed envelope to the following address: Frederick Shotton, 19 Weidelaan, 1980 Tervuren, Belgium. ■

(listing continued from opposite page)

```
3300 IF STICK(0)<>7 OR XX>17 THEN 3400
3310 COLOR ASC(CHAR$(0))+128:PLOT XX+
1,YY:COLOR ASC(CHAR$(1))+128:PLOT XX+
2,YY:GOSUB 3900
3311 FOR I=1 TO 10:SOUND 0,I,6,15:NEX
T I:SOUND 0,0,0,0
3315 FOR I=1 TO 10:NEXT I:COLOR 0:PLO
T XX+1,YY:PLOT XX+2,YY:GOTO 8998
3400 IF STICK(0)<>11 OR XX<2 THEN 4000
3410 COLOR ASC(CHAR$(10))+128:PLOT XX-
2,YY:COLOR ASC(CHAR$(11))+128:PLOT XX-
1,YY:GOSUB 3900
3411 FOR I=1 TO 10:SOUND 0,I,6,15:NEX
T I:SOUND 0,0,0,0
3415 FOR I=1 TO 10:NEXT I:COLOR 0:PLO
T XX-1,YY:PLOT XX-2,YY:GOTO 8998
3900 OX=OX-10
3905 IF PEEK(53252)=4 OR PEEK(53252)=5
 THEN SC=SC+400:POKE 53256,1:FOR I=1 T
O 100:NEXT I:POKE 53256,0:AL0=1:RETURN
3910 IF PEEK(53253)=4 OR PEEK(53253)=5
 THEN SC=SC+400:POKE 53257,1:FOR I=1 T
O 100:NEXT I:POKE 53257,0:AL1=1:RETURN
3920 IF PEEK(53254)=4 OR PEEK(53254)=5
 THEN SC=SC+400:POKE 53258,1:FOR I=1 T
O 100:NEXT I:POKE 53258,0:AL2=1:RETURN
3930 IF PEEK(53255)=4 OR PEEK(53255)=5
 THEN SC=SC+400:POKE 53259,1:FOR I=1 T
O 100:NEXT I:POKE 53259,0:AL3=1:RETURN
3940 RETURN
4000 POKE 53278,0:LOCATE XX,YY,WW
4010 IF WW=ASC(CHAR$(13)) THEN SC=SC+5
00:GOSUB 11000
4020 IF WW=ASC(CHAR$(14)) THEN SC=SC+7
50:GOSUB 11000
4030 IF WW=ASC(CHAR$(5)) THEN SC=SC+1
4040 IF WW=ASC(CHAR$(16)) THEN OX=OX+5
0:SC=SC+100:GOSUB 11000
4045 IF WW=ASC(CHAR$(15)) THEN GOSUB 4
00
4050 FOR I=0 TO 3
4060 IF PEEK(53252+I)=4 OR PEEK(53252+
I)=5 THEN GOSUB 400
4070 NEXT I
4999 IF YE=1 THEN OX=OX-2:RETURN
5000 EA=EA+1:IF EA>=243 THEN 107
5010 OX=OX-1:IF OX<=0 THEN 500
6000 IF OX<180 AND OX>150 THEN 6100
6005 IF OX<50 AND OX>30 THEN W=1:GOTO
6100
6010 IF OX<130 AND OX>120 THEN 6200
6020 IF OX<80 OR OX>50 THEN 6300
6050 GOTO 7000
6100 COLOR ASC(CHAR$(16)):IF E=1 THEN
Z=INT(RND(0)*18)+1:C=INT(RND(0)*16)+3:
PLOT Z,C:E=0
6110 IF OX<=151 OR OX<=31 THEN COLOR 0
:PLOT Z,C
6120 GOTO 7000
6200 RR=13:IF RND(0)>0.5 THEN RR=15
6205 COLOR ASC(CHAR$(RR)):IF W=1 THEN
Z1=INT(RND(0)*18)+1:C1=INT(RND(0)*16)+
3:PLOT Z1,C1:W=0
6210 IF OX<=121 THEN COLOR ASC(CHAR$(1
5)):PLOT Z1,C1
6220 GOTO 7000
6300 COLOR ASC(CHAR$(14)):IF Q=1 THEN
Z2=INT(RND(0)*18)+1:C2=INT(RND(0)*16)+
3:PLOT Z2,C2:Q=0
6310 IF OX<=51 THEN COLOR ASC(CHAR$(15
)):PLOT Z2,C2
6320 GOTO 7000
7000 REM
7001 REM ..................
7002 REM MOVE MONSTERS
7003 REM ..................
8998 IF AL0=1 AND AL1=1 AND AL2=1 AND
AL3=1 THEN 105
8999 IF AL0=1 THEN X0=0:Y0=0:POKE PLX,
X0:GOTO 9099
9000 IF STICK(0)=14 AND Y0>60 THEN Y0=
Y0-V0:POKE PLY,Y0
9010 IF STICK(0)=13 AND Y0<170 THEN Y0
=Y0+V0:POKE PLY,Y0
9020 IF STICK(0)=7 AND X0<170 THEN X0=
X0-V0:POKE PLX,X0
9030 IF STICK(0)=11 AND X0>60 THEN X0=
X0-V0:POKE PLX,X0
9040 IF STICK(0)<>15 THEN 9099
9050 IF XX>INT(X0/20) AND X0<170 THEN
X0=X0+V0:POKE PLX,X0
9060 IF XX<INT(X0/20) AND X0>60 THEN X
0=X0-V0:POKE PLX,X0
9070 IF YY<INT(Y0/20) AND Y0>55 THEN Y
0=Y0+V0:POKE PLY,Y0
9080 IF YY>INT(Y0/20) AND Y0<170 THEN
Y0=Y0+V0:POKE PLY,Y0
9099 IF AL1=1 THEN X1=0:Y1=0:POKE PLX+
1,X1:GOTO 9199
9100 IF XX>10 AND X1<170 THEN X1=X1+9:
POKE PLX+1,X1
9110 IF XX<10 AND X1>60 THEN X1=X1-9:P
OKE PLX+1,X1
9120 IF YY<10 AND Y1<170 THEN Y1=Y1+9:
POKE PLY+1,Y1
9150 IF YY>10 AND Y1>60 THEN Y1=Y1-9:P
OKE PLY+1,Y1
9199 IF AL2=1 THEN X2=0:Y2=0:POKE PLX+
2,X2:GOTO 9299
9200 IF XX>10 AND X2>60 THEN X2=X2-V2:
POKE PLX+2,X2
9210 IF XX<10 AND X2<170 THEN X2=X2+V2
:POKE PLX+2,X2
9220 IF YY<10 AND Y2>60 THEN Y2=Y2-V2:
POKE PLY+2,Y2
9230 IF YY>10 AND Y2<170 THEN Y2=Y2+V2
:POKE PLY+2,Y2
9299 IF AL3=1 THEN X3=0:Y3=0:POKE PLX+
3,X3:GOTO 1000
9300 IF STICK(0)=14 AND Y3<170 THEN Y3
=Y3+V3:POKE PLY+3,Y3
9310 IF STICK(0)=13 AND Y3>60 THEN Y3=
Y3-V3:POKE PLY+3,Y3
9320 IF STICK(0)=7 AND X3>60 THEN X3=X
3-V3:POKE PLX+3,X3
9330 IF STICK(0)=11 AND X3<170 THEN X3
=X3+V3:POKE PLX+3,X3
9340 IF STICK(0)<>15 THEN 1000
9350 IF XX>INT(X3/20) AND X3<170 THEN
X3=X3+V3:POKE PLX+3,X3
9360 IF XX<INT(X3/20) AND X3>60 THEN X
3=X3-V3:POKE PLX+3,X3
9370 IF YY<INT(Y3/20) AND Y3<170 THEN
Y3=Y3+V3:POKE PLY+3,Y3
9380 IF YY>INT(Y3/20) AND Y3>60 THEN Y
3=Y3-V3:POKE PLY+3,Y3
10000 GOTO 1000
11000 FOR I=200 TO 225:SOUND 0,I,12,15
:NEXT I:SOUND 0,0,0,0:RETURN
19999 REM CHANGE CHSET
20000 DIM CHAR$(17):CHAR$="!(,HXXQ'^;
)Z`\]"
20010 CHSET=(PEEK(106)-8)*256:CHORG=57
344:FOR I=0 TO 511:POKE CHSET+I,PEEK(C
HORG+I):NEXT I
20015 RESTORE 20050
20020 FOR I=1 TO 16:CHPOS=CHSET+ASC(C
HAR$(I))-32)*8:FOR J=0 TO 7:READ A:POK
E CHPOS+J,A:NEXT J:NEXT I
20030 FOR I=32 TO 39:POKE CHSET+I,255-
PEEK(CHORG+I):NEXT I:POKE 756,CHSET/25
6:RETURN
20049 REM DATA FOR SHAPES
20050 DATA 24,24,88,252,88,24,36,36,24
,24,26,63,26,24,36,36,16,56,19,124,124
,19,0,0,0,0,200,62,62,200,28,0
20060 DATA 255,255,255,255,255,255,255
,255,16,152,252,116,238,131,0,0,0,152,
141,177,162,127,43,64
20070 DATA 0,10,67,119,249,110,1,0,49,
98,140,242,216,78,31,0,32,80,145,34,18
,10,10,4
20080 DATA 0,0,140,140,83,81,34,0,16,1
7,7,75,107,128,96,16,34,24,126,219,387
,94,52,24
20090 DATA 14,21,100,116,116,110,14,4,
40,50,101,186,111,221,118,44,153,126,1
02,219,219,102,126,153
24999 REM ...PM GRAPHICS SUBROUTINE
25000 RESTORE 26000:FOR I=1536 TO 1706
:READ A:POKE I,A:NEXT I:FOR I=1774 TO
1787:POKE I,0:NEXT I
25010 PM=PEEK(106)-16:PMBASE=256*PM:FO
R I=PMBASE+1023 TO PMBASE+2047:POKE I,
0:NEXT I
25020 FOR I=PMBASE+1025 TO PMBASE+1032
:READ A:POKE I,A:NEXT I
25030 FOR I=PMBASE+1281 TO PMBASE+1288
:READ A:POKE I,A:NEXT I
25040 FOR I=PMBASE+1537 TO PMBASE+1544
:READ A:POKE I,A:NEXT I
25050 FOR I=PMBASE+1793 TO PMBASE+1800
:READ A:POKE I,A:NEXT I
25060 POKE 704,198:POKE 705,20:POKE 70
6,70:POKE 707,228
25070 PLX=53248:PLY=1780:PLL=1784:POKE
 559,62:POKE 623,1:POKE 1788,PM+4:POKE
 53277,3:POKE 54279,PM
25075 FOR I=0 TO 3:POKE PLL+I,8:NEXT I
25080 [illegible]
26000 DATA 162,3,189,244,6,240,89,56,2
21,240,6,240,83,141,254,6,106,141
26010 DATA 252,6,142,253,6,24,159,0,10
9,253,6,24,109,252,6,133,204,133
26020 DATA 206,189,240,6,133,203,173,2
54,6,133,205,189,288,6,170,232,46,255
26030 DATA 6,144,15,168,177,203,145,20
5,169,0,145,203,136,202,208,244,76,87
26040 DATA 6,160,0,177,203,145,205,167
,0,145,205,206,202,208,244,174,253,6
26050 DATA 173,254,6,157,240,6,189,236
,6,240,48,133,203,24,138,141,253,6
26060 DATA 106,235,6,133,204,24,173,25
3,6,139,252,6,133,206,189,240,6,133
26070 DATA 205,189,248,6,170,160,0,177
,203,145,205,200,232,208,248,174,253,6
26080 DATA 169,0,157,236,6,202,48,3,76
,2,6,76,98,228,0,0,104,169
26090 DATA 7,162,6,160,0,32,92,228,96
26100 DATA 153,126,90,126,102,189,165,
165,129,126,90,102,126,165,24,102
26110 DATA 288,90,102,60,36,60,66,195,
24,102,36,189,126,24,36,102
30000 RESTORE 30001:FOR I=256 TO 256+1
18:READ A:POKE I,A:NEXT I:RETURN
30001 DATA 104,169,11,141,38,2,169,1,1
41,39,2,174,55,1,139,56,1,141,6,210
30002 DATA 24,105,2,141,4,210,169,164,
141,7,210,141,5,210,238
30003 DATA 55,1,174,55,1,224,63,208,5,
169,0,141,50,1,169,10,141,24,2,96
30004 DATA 0,193,128,144,128,162,128,1
82,128,193,182,162,128,144,162,182,182
,193,128,144,128,152,128,182
30005 DATA 128,193,182,162,128,162,192
,193,193,253,217,253,217,243,193,243,1
93,217,182,217,182,193,217,243,243
30006 DATA 253,217,253,217,243,193,243
,193,217,182,193,243,253,217,253,253
```



Illusions October 1983



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December issue: Program Features: Killer Dice game, **Galactic Invasion**, a fast moving space invasion game, **LINK**, a very useful disc utility for program development, **ASTAAD**, a really excellent program for **Computer Aided Design**, the **Percussion Machine**, moving **Chequer Board** display, **Screen Freezer**, a routine to freeze your favourite game in mid-play and a musical rendering of the **Twelve Days of Christmas to add a seasonal flavour. Plus articles on the Teletext Mode** (part 3) and **Fitting an External Speaker**. Plus **Disc Drive Reviews, Book Reviews**, Hints and Tips.

Jan/Feb issue: Program Features. Block Blitz, an excellent arcade style game. **A Disassembler for the BBC micro**, the **Ray Box game** to test your powers of deduction, **Large Digital Displays in Mode 7. Dancing Lines**, an interesting visual demonstration of random numbers. Plus articles on **Machine Code Graphics**, the first of an introductory series, **Teletext Mode** (Part 4) with a set of useful procedures, **Protecting your own programs**, and an **Introduction to forth**. Plus reviews of **Double Density Disk Controllers. Graphics Tablets. new Software. Product news**. Post bag. Hints and Tips

March Issue: Program features: Krazy Football Ogame, the **Manhole** game, requiring quick thought and fast reaction, **Extending ASTAAD**, our popular **Computer Aided Design** Program. **The Stonemason, Multiple Disc Catalogues**, a program version of **Bach's Cantata No.147**, a program for **Printing Your Own Function Key Labels. Plus articles on Acorns's Latest Developments, Testing Out Your Micro (Sideways ROMs), Machine Code Graphics** (part 2). **Compact Function Key Definitions.** Plus **Reviews of FORTH** for the BBC micro, **Memory Expansion Board Review. Software Reviews, Hints and Tips.**

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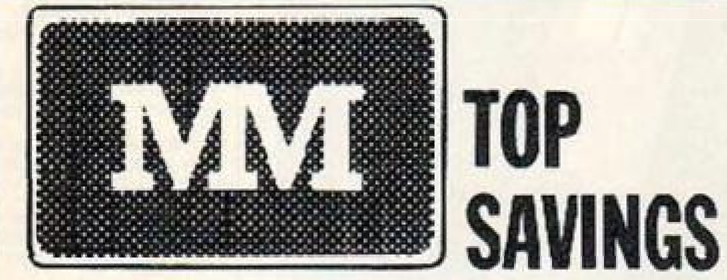
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MAYFAIR MICROS

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Do you have a problem? Your manual is incomprehensible or you just cannot get the hang of that programming trick you tried — whatever it is, Tim Hartnell will do his best to answer your queries. Please include only one question per letter and mark them "Response Frame".

SIDEWAYS SCROLL

I own a BBC Micro, Model B. I have noticed an effect in many arcade games, on the Beeb and on other machines, that I would like to copy. That is, the sideways scrolling of the screen. I have read routiens in a couple of places that I am totally unable to understand. I do not want a complicated machine-code solution to my problem and wonder if there is some way it could be done in Basic.

Walter Barnard, London, W12.

ACCORDING TO Ross Symons — author of *Beginner's Guide to Assembly Language on the BBC Micro* — the simplest way of getting a sideways scroll on the BBC is to include the followin in a program:

```
?850 = 1
```

You will see now that Control K moves the screen right, and Control J moves it left. You can get the screen to scroll right by Tabbing to the bottom of the screen, and Tabbing at the top to get it to scroll left. That is, if you include

```
PRINTTAB(0,0);CHR$(11)
```

in your program, the screen will scroll every time it hits that line. Similarly,

```
PRINT TAB(0,24)
```

will cause it to scroll the other way.

GETTING OUT

I have a lot of trouble with Insert mode when editing programs on the Vic-20. Is there a way of disabling this mode?

Paul Gordon, Hoibury, Southampton

SIMPLY EXECUTE Poke 216,0 in the direct mode, and Insert mode will be disabled.

WHO'S FAULT

I have recently bought a 48K Spectrum and have found that the numbers produced by the In statements used to read the keyboard differ from those in programs in magazines. For example, when no key has been pressed, the number produced is 191 instead of 255. Is this a fault?

C Smith, Salisbury, Wiltshire.

NO, THIS IS not a fault. There have been three issues of Spectrums. Issues one and two used different Ins to those on issue three generally.

With most Basic programs this does not cause an insurmountable problem. You need to do two things to modify old Spectrum programs to run on your machine. The first thing is simply to read the instructions for the program, and determine which key press achieves which aim — such as pressing the F key to fire, or whatever. Then, you need to write a short routine which will return to you the In values when various keys are pressed. Next, press the keys you need from the original program — such as F — and substitute the figure you get from your routine for all occurences of the original figure in the listing you are entering. You should find then that you have no further problems.

ALTERNATIVE MID$

I have written two data-file type programs for my ZX Spectrum for home use. However, my programs lack a fast and efficient string search routine. Could you sugest a simple routine for the Spectrum to search a long string for a short string as in the BBC's:

```
100 FOR J = 1 TO LEN (LONG$)
    - LEN (SHORT$) + 1
110 IF SHORT$ = MID$(LONG$,J,
    LEN(SHORT$)) THEN 200
120 NEXT J
```

I have tried to adapt this very simple yet fast routine, but cannot find an alternative to Mid$ which the Spectrum does not have.

Kenneth Watson, Gateshead, Tyne and Wear

THE ROUTINE you have given for the BBC commits an unpardonable sin, jumping out of an incomplete loop. Run this on the computer for very long, and the BBC Micro would crash with an out of memory error. Although the ZX machines allow you to jump out of loops with impunity, it is extremely bad programming practice, as very few other computers are as tolerant.

Putting that aside, it is unfortuante that the Instr$ command, which searches through one string for the occurence of another, and returns a number which is the starting position of the second string — or zero if it is not found — is not available on the Spectrum. This would solve your problem very quickly.

All the standard string-handling commands — Left$, Mid$, Right$ — can be emulated in ZX Basic. The following program, although not brilliantly efficient, should do the job for you.

```
10 A = LEN(LONG$):B = LEN
   (SHORT$)
20 J = 1
30 IF LONG$(J TO B - 1) = SHORT$
   THEN 60
40 IF J<A THEN J = J + 1:GOTO 30
50 PRINT "NOT FOUND":GOTO 70
60 PRINT "STRING FOUND,
   STARTING AT ELEMENT";J
```

Note how lines 20 and 40 do not create a loop which will be prematurely exited.

LETTER PRINT

I have a Vic-20 computer and I have made a program to write a letter. Could you please tell me how I could print that letter out on a printer? The address is in Print statements and the letter is written as inputs ie., A$, B$, etc.

A R Lilly, Bishop Auckland, County Durham.

IT IS UNFORTUNATE that the Commodore computers do not allow the simple access to printer afforded by many other machines. To dump a screen, for example, is a quite torturous process, and even listing a program requires three steps.

To solve your particular problem, you need to include #4, After the word Print and before the material you want to Print as follows:

```
PRINT # 4, "YOUR ADDRESS" or
PRINT # 4, A$
```

To turn the printer on, enter Open 4,4 then press Return, followed by CMD4 and again press Return. Then run your program, making sure you include a Close 4 at the very end.

MICRODRIVE COPY

Could you answer a question that I am sure is uppermost in the minds of all Spectrum owners interested in the Microdrive. Is it possible to copy one's own cassette-based commercial software onto the Microdrive to enable faster loading?

Ken Watson, Gateshead, Tyne and Wear.

COPYING ONTO the Microdrives presents the same obstacles as copying a commercial "save-blocked" cassette onto cassette. If you can save a program onto cassette, you can save it onto Microdrive. If the program has been saved so that it cannot be resaved onto another cassette, without the use of the one of the "lock breaker" programs, then you will not be able to save it onto Microdrive.

ACOUSTIC MODEMS

I am interested in purchasing a computer for 'over-the-telephone' line networking. At the moment, I own a Spectrum, but am interested in the Vic-20 or the Commodore 64. Could you please tell me if there is a Modem available for either of these — preferably an acoustic Modem? I have seen one Modem which plugs directly into the telephone socket. Does this mean that the computer can be programmed to dial a telephone number?

Ian Curnock, Inkberrow, Worcestershire.

FIRST, LET ME say that as far as I have been able to ascertain, it is illegal to plug Modems directly into the telephone lines in the UK, which is why so many acoustic Modems are available for various machines. It is quite feasiable for a computer — using an acoustic Modem — to dial a number for you, so a plug-in Modem would, of course, be able to do the same thing.

Acoustic Modems have been produced for both the machines you ask about, although it may not be too easy to get hold of them. I have looked through the latest issues of *Commodore Horizons* and *Commodore User* and did not see a single advertisement for Modems for either machines.

However, before you rush out and buy the computer of your choice, you had better determine who or what it is you will be communicating, via the telephone and computer, with. Are you intending to talk to friends, access Prestel or whatever? It would make sense to make your decision of which microcomputer to buy for this purpose on the machines which your associates — if it is them you wish to talk with — already have.

JUPITER DAWN

Now that Jupiter Cantab have gone out of business, does that mean that I, and thousands of other Jupiter Ace owners, are going to be left out in the cold? I had not had my Ace long when I heard about the company folding. I think this is most unfortunate as I was just at the point of expanding my machine. Is there anyone still out there who is supporting this great little computer?

Neville Wright, London E17.

THERE HAS BEEN no indication from manufacturers supporting the Jupiter Ace that they will withdraw that support, simply because the computer is no longer available. The Pace: 16K RAM unit is one of several expansion units available for the Ace, and sells for £20. It can be further expanded, for £14.50, to bring the Ace's full memory to 32K.

COMPUTER CAMP

In a recent issue of Your Computer I mentioned a few computer camps in response to a query from Malcolm Parks of Amersham. Following the publication of that letter, I heard from Cyril Tyson, director of Camp Aldenham, which is a "non-residential adventure and computer camp for boys and girls from five to 13 years", near Letchmore Heath, about 20 miles from central London.

The computer camp is designed for children between nine and 13 years old and consists of one session of two hours each day. If you want to know more, write to the camp for a brochure at Camp Aldenham, Aldenham School, Elstree, Herts, WD6 3AJ.

SOFTWARE FILE

Software File gives you the opportunity to have your programs, ideas and discoveries published. We will accept contributions for any home computer provided they are submitted to *Your Computer* exclusively. Please double-check your programs and specify the memory they require before sending them, preferably on cassette. We pay between £6 and £36 for contributions published.

Jump Bug



Umer Nalla,
Bolton.

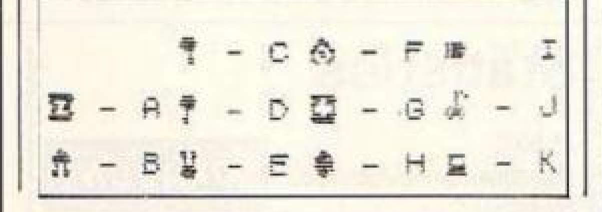
Called Jump Bug and for a 16K or 48K ZX Spectrum, this game involves getting a bug to the top of the screen, by jumping through gaps in the platforms. On the first sheet it is fairly easy but on following sheets, hazards are introduced, such as a cannon-ball, a missile and a heat-seeking mutant alien. The platforms also get to move faster as the skill increases. When you lose a life, you will be informed of the cause.

Type in program 1 and check it twice. Then Run it and Save it to tape. Type New to clear the computer, *not* USR 0, as this will clear the machine code as well. Now type in program 2 Save this by typing

GOTO 999

and Verify it. Now Run it. If the program crashes, reload both programs and check the first for mistakes in data and correct mistakes. If none exists then check all the Poke and USR address in program 2. Correct any mistakes.

The program should now run successfully.



Program 1.

```
  10 BORDER 2: PAPER 0: INK 0
  20 CLEAR 32243
  40 PRINT AT 11,5; INK 7; FLASH
 1; BRIGHT 1;"Please wait a mome
nt"
  50 FOR a=32244 TO 32494
  60 READ b: POKE a,b: NEXT a
  70 DATA 14,8,229,17,31,0,25,12
6,237,82,31,0,32,126,31,119,35,1
6,250,225,36,13,32,234,201
  80 DATA 14,8,175,229,17,31,0,2
37,82,126,25,23,5,32,126,23,119,
43,16,250,225,36,13,32,233,201
  90 DATA 33,95,64,205,13,126,33
,128,64,205,244,125,33,128,64,20
5,244,125,33,223,64,205,13,126,0
3,0,72,205,244,125,33,0,72,205,2
44,125,33,0,72,205,244,125
 100 DATA 58,121,92,0,0,0,0,0,0,
0,230,2,40,20,33,64,72,205,244,1
25,33,64,72,205,244,125,33,64,72
,205,244,125,24,18,33,95,72,205,
13,126,33,95,72,205,13,126,33,95
,72,205,13,126
 110 DATA 33,128,72,205,244,125,
33,192,72,205,244,125,33,192,72,
205,244,125,33,31,80,205,13,126,
33,31,80,205,13,126,33,95,80,205
,13,126,201
 120 DATA 33,128,72,205,244,125,
33,192,72,205,244,125,33,31,80,2
05,13,126,33,95,80,205,13,126,20
1
 130 DATA 33,95,64,205,13,126,33
,128,64,205,244,125,33,0,72,205,
244,125,201
 140 DATA 33,95,64,205,13,126,33
,223,64,205,13,126,33,128,72,205
,244,125,33,192,72,205,244,125,2
01
 150 PRINT AT 11,5; INK 0; PAPER
 7; FLASH 1; BRIGHT 1;"   LOADI
NG ■■"; INVERSE 1;"FLASH 1;"
 160 PRINT AT 0,0;: LOAD ""
 999 SAVE "jump bug" LINE 1
```

Program 2.

```
   1 REM    PROGRAM 2
   2 REM by U.Nalla
   4 LET ms=2: LET lives=4: LET
sc=0: LET sk=-1: BORDER 6: PAPER
 6: INK 1: CLS : POKE 32425,201
 POKE 32450,201: POKE 32469,201:
 GO TO 5010
   5 LET bx=3: LET by=15: LET mx
=3: LET my=1: LET u=1: LET ax=3:
 LET ay=15: LET x=19: LET y=16:
LET m$="▲": LET o$="●"
  10 PRINT AT 0,23;"MEN ";lives:
 PRINT : FOR k=1 TO 18 STEP 2: P
RINT BRIGHT 1; INK 0; PAPER 7;"■
■■■■■■■■■■■■■■■■■■■■■■■■■■■■■■■"
: PRINT : NEXT k
  15 FOR k=2 TO 18 STEP 2: FOR j
=1 TO INT (RND*sk)+1: PRINT AT k
,INT (RND*26)+2; BRIGHT 1; PAPER
 7;"  ": NEXT j: NEXT k
  16 PRINT AT 2,0; BRIGHT 1; PAP
ER 0; INK 7;"■■■■■■■■■■■■■■■■   ■■
■■■■■■■■■■■■■■"
  18 PRINT AT 20,0; PAPER 5; INK
 3; BRIGHT 1; FLASH 1;"^^^^^^^^^^
^^^^^^^^^^^^^^^^^^^^^^"
  25 PRINT AT 1,1; INVERSE 1; PA
PER 7;"✱✱✱✱✱✱✱✱✱✱✱✱✱✱✱"; FLASH 1;
 INK 6; PAPER 1;"##"; FLASH 0; P
APER 7; INK 1;"✱✱✱✱✱✱✱✱✱✱✱✱✱✱✱"
  40 FOR x=2 TO (INT (RND*5)+4)*
2 STEP 2: PRINT AT x,INT (RND*30
)+1; INK 1; PAPER 5; FLASH 1;"■"
: NEXT x
  99 FOR u=1 TO 5 STEP 0
 100 BEEP .001,15: LET lx=x: LET
 ly=y: PRINT AT x,y; INK 5; PAPE
R 6;m$
 105 IF INKEY$<>"p" AND INKEY$<>
"o" AND INKEY$<>"q" THEN LET a$=
"": GO TO 130
 107 LET a$=INKEY$
 110 IF a$="q" THEN IF SCREEN$ (
x-1,y)=" " THEN LET x=x-2: LET o
$=m$: LET m$="▲": LET a$="": FOR
 k=1 TO 6: BEEP .05,k*5: RESTORE
 USR 32295: NEXT k: LET sc=sc+20
: GO TO 130
 115 IF a$="q" THEN IF SCREEN$ (
x-1,y)="" THEN GO SUB 8050: GO T
O 8010
 120 IF a$="p" THEN LET m$="●"
 125 IF a$="o" THEN LET m$="●"
 130 IF SCREEN$ (x,y)="£" THEN G
O TO 5000
 132 LET y=y+(m$="●")-(m$="●")
 135 IF y=ly THEN LET m$=o$
 140 IF y>30 THEN LET y=1
 145 IF y<1 THEN LET y=30
 150 FOR k=0 TO sk-1: RESTORE US
R 32295: NEXT k
 160 IF SCREEN$ (x-1,y)=" " THEN
 GO SUB 8050: GO TO 8000
 162 IF a$="" THEN LET a$="p"
 165 IF x=1 THEN IF SCREEN$ (x,y
)="" THEN GO SUB 8050: GO TO 801
0
 167 IF ATTR (x,y)=169 THEN BEEP
 .5,30: BEEP .05,20: LET sc=sc+1
00
 170 PRINT AT lx,ly;" ";AT x,y;
INK 3; PAPER 6;m$;AT 0,2; INVERS
E 1;"SCORE ";sc;
 175 IF sk<1 THEN NEXT u
 180 LET ox=ax: LET oy=ay: PRINT
 AT ax,ay; INK 2; PAPER 6;"●"
 190 IF SCREEN$ (ax+1,ay)=" " TH
EN LET ax=ax+2: BEEP .02,50
 195 LET ay=ay+s: IF ay>29 OR ay
<2 THEN LET s=s*-1: IF ax=19 THE
N LET ax=3
 200 PRINT AT ox,oy;" ";AT ax,ay
; INK 2; PAPER 6;"●"
 205 IF ax=x THEN IF ay=y OR ay+
1=y OR ay-1=y THEN GO SUB 8050:
GO TO 8030
 208 IF sk<2 THEN NEXT u
 210 LET xo=mx: LET yo=my: PRINT
 AT mx,my; INK 4;"■": IF my+ms>2
7 THEN LET mx=mx+2: LET my=1: IF
 mx>19 THEN LET mx=3
 220 IF mx=x THEN IF my<=y THEN
IF my+ms>=y THEN GO SUB 8050: GO
 TO 8020
 230 LET my=my+ms: PRINT AT xo,y
o;" ";AT mx,my;"■": BEEP .0008,2
0: BEEP .0008,15
 240 IF sk<3 THEN NEXT u
 250 LET cx=bx: LET cy=by: PRINT
 AT bx,by;"▲": LET a=INT (RND*10
)+1: LET bx=bx+2: LET by=by+(y>b
y AND a<4)-(y<by AND a>6): IF bx
>19 THEN LET bx=3
 260 PRINT AT cx,cy;" ";AT bx,by
;"▲": BEEP .0008,35
 265 IF bx=x AND by=y THEN GO SU
B 8050: GO TO 8020
 270 NEXT u
 280 GO TO 99
5000 LET sc=sc+200: FOR k=1 TO 1
00: NEXT k: BORDER 7: PAPER 7: I
NK 3: CLS : BEEP .1,10: BEEP .1,
20: BEEP .5,15: PRINT AT 2,10; F
LASH 1; BRIGHT 1;"WELL DONE!": P
AUSE 50: PRINT PAPER 7; INK 3;'T
AB 6;"BUT ";: BEEP .5,6: PRINT "
NOW ";: BEEP .5,4: PRINT "IT ";:
 BEEP .5,3: PRINT "GET'S ": BEEP
 .5,2: PRINT AT 6,11; BRIGHT 1;"
 HARDER ": BEEP .5,1: BEEP .5,10
5010 PAUSE 50: LET sk=sk+1: IF s
k>3 THEN LET sk=3
5015 PRINT AT 9,5; BRIGHT 1; INK
 3; PAPER 7;"HOW HIGH CAN YOU TR
Y?";AT 0,7; INK 0; PAPER 6; FLAS
H 1;" J U M P B U G "
5020 FOR q=0 TO sk: BEEP .5,q: P
RINT AT 18-(q*2),15; INK q;CHR$
(150+q);"   ";(q-1)*50;" M": NE
XT q
5030 PAUSE 50
5060 IF sk=1 THEN POKE 32425,0
5065 IF sk=2 THEN POKE 32450,0
5070 IF sk=3 THEN POKE 32469,0
5075 IF sk>=2 THEN LET ms=ms+1:
IF ms>5 THEN LET ms=5
5080 IF sk>3 THEN LET sk=3
5090 PAUSE 50: FOR k=0 TO 10: BE
EP .005,55: PRINT AT 21,k;" "; F
LASH 1; BRIGHT 1; PAPER 7; INK 0
;"S to start": NEXT k
5100 BEEP .05,40: BEEP .05,50: B
EEP .05,30: BEEP .05,59: IF INKE
Y$<>"s" THEN GO TO 5100
5110 BORDER 6: PAPER 6: INK 1: C
LS : GO TO 5
6000 LET lives=lives-1: IF lives
<1 THEN GO TO 6100
6010 PAUSE 50: PRINT AT 21,2;"Pr
ess any key to continue": PAUSE
0: CLS : GO TO 5
6100 INPUT "Press ENTER to play
"; LINE a$: RUN
7999 STOP
8000 PAUSE 10: PRINT AT lx,ly;"
";AT 19,y; FLASH 1; BRIGHT 1;"■"
; BRIGHT 0;AT 21,2;"fell through
 a hole ": GO TO 6000
8010 PRINT AT lx,ly;" ";AT 19,y;
 FLASH 1; BRIGHT 1;"■"; BRIGHT 0
;AT 21,2;"banged your head": GO
TO 6000
8020 PRINT AT 21,2; FLASH 1; BRI
GHT 1;"Shot!!": GO TO 6000
8030 PRINT AT 21,2; FLASH 1; BRI
GHT 1;"Bowled!!": GO TO 6000
8040 PRINT AT 21,2; FLASH 1; BRI
GHT 1;"Mutated!!": GO TO 6000
8050 FOR k=1 TO 100: NEXT k: FOR
 k=59 TO 10 STEP -2: BEEP .001,k
: NEXT k: FOR k=1 TO 2: FOR j=x
TO 19 STEP 2: PRINT AT j,y;"■";A
T j-2,y;" ": BEEP .01,j*5: NEXT
j: NEXT k
8060 FOR k=4 TO 1 STEP -1: PRINT
 AT 19,y; BRIGHT 1; FLASH 1;CHR$
 (144+k): PAUSE 13: BEEP .5,k: N
EXT k
8070 RETURN
9000 STOP
9990 RESTORE 9991: FOR k=USR "a"
 TO USR "k"+7: READ a: POKE k,a:
 NEXT k
9991 DATA 255,255,195,102,102,19
5,255,255,24,60,126,126,36,36,10
2,102,60,120,126,60,6,6,12,12,60
,126,126,60,16,16,48,48
9992 DATA 102,102,36,36,60,126,1
26,60,24,60,102,195,153,153,195,
102,255,231,231,129,129,231,255,
255
9993 DATA 24,60,122,126,126,122,
60,24,0,0,185,190,255,190,188,0,
20,19,16,16,54,155,156,66
9994 DATA 0,0,126,66,66,126,126,
255
9997 RETURN
9998 SAVE "JUMP" LINE 9999: STOP
9999 GO SUB 9990: RUN
```

Buzz

Tony Davies,
West Bridgford,
Nottinghamshire.



This is a family game, notable for its cartoon-quality graphics, which show to advantage the ease with which the Draw and Paint commands of the Dragon can be used to produce such effects. It also has fast-moving

(continued on next page)

```
5 CLEAR5000:CLS
6 PRINT@200,"COPYRIGHT":PRINT@264,"R.A.DAVIS":PRINT@32
8,"1983"
10 PMODE3,1:PCLS
11 M1$="L402AL8GGL4F+GG+AG+A"
12 M2$="BL8AAL4G+ABO+CO-BO+C"
13 M3$="O3DCO-BO+CO-BAG+A"
14 M4$="GBA+BAGF+G"
15 M5$="O3L2DL4O-GGO+L2DL4CL2C"
16 M6$="T4;XM1$;XM2$;XM3$;XM4$;XM1$;XM2$;XM3$;XM5$;"
17 GOSUB2000
```

(listing continued on next page)

(continued from previous page)

action and a continuous display of scoring, with a high-score feature.

The screen displays a lily-pond with a frog sitting on one of the lily-pads. By using the right-hand joystick and its fire button, you can aim the frog's tongue to hit the buzzing fly and so score points. If, however, you hit the wasp instead, your score will revert to zero.

There are nine levels of difficulty and a choice of game length from one to three minutes. The listing also gives a signature tune — The Blue-Tail Fly — and an introductory display, which give the final product some polish.

Line	Function
11-16	Make the tune.
19	Introduction.
20-310	The background.
320-440	The frog.
450-560	The scoring.
561-568	The options.
600-637	The wasp and fly (O$ and A$)
675-740	The action and check for hit routine.
2000-2195	The titling.

(listing continued from previous page)

```
[illegible]
```

Reset control

M Warren,
Lewes,
Sussex.



THE ORIC HAS A RESET button. It works extremely well, except that to operate it requires the use of a screwdriver or some other similar object. As a more professional method, here is a routine that allows Ctrl Z to be used instead.

It works by intercepting interrupts and diverting them to 400 hex, where a short routine checks to see if Control and Z are pressed. If they are, control passes to a ROM routine at F400 hex — the reset routine.

```
10 REPEAT
20 READ D$
30 C=VAL("#"+D$)
40 POKE #400+T,C
50 T=T+1
60 UNTIL D$="END"
70 :
100 DATA48,8A,48,98,48,20,00,97,68,A8
110 DATA68,AA,68,4C,03,EC,"END"
120 T=0
130 REPEAT
140 READ D$
150 C=VAL("#"+D$)
160 POKE #9700+T,C
170 T=T+1
180 UNTIL D$="END"
200 DATAAD,09,02,C9,A2,FC,01,60
210 DATAAD,OF,03,C9,DF,FC,01,60
220 DATAAD,10,03,C9,BA,FC,01,60
230 DATA4C,30,F4,"END"
240 DOKE #229,#400
250 NEW
260 REM **********CHECK & SAVE
    BEFORE RUNNING!*****
```

Statistics

P Hill,
Carshalton Beeches,
Surrey.



THIS STATISTICS PROGRAM is for the Dragon 32, using approximately 19K of memory with an optional printout using the Seikosha GP-100A printer. It contains six sub-programs allowing you to display a pie chart — lines 850-1080; the mean, variance and standard deviation — lines 1090-1250; a percentage break-down — lines 1260-1390; a bar graph — lines 1400-1550; a frequency polygon — lines 1560-1660 — and a histogram — lines 1670-1840.

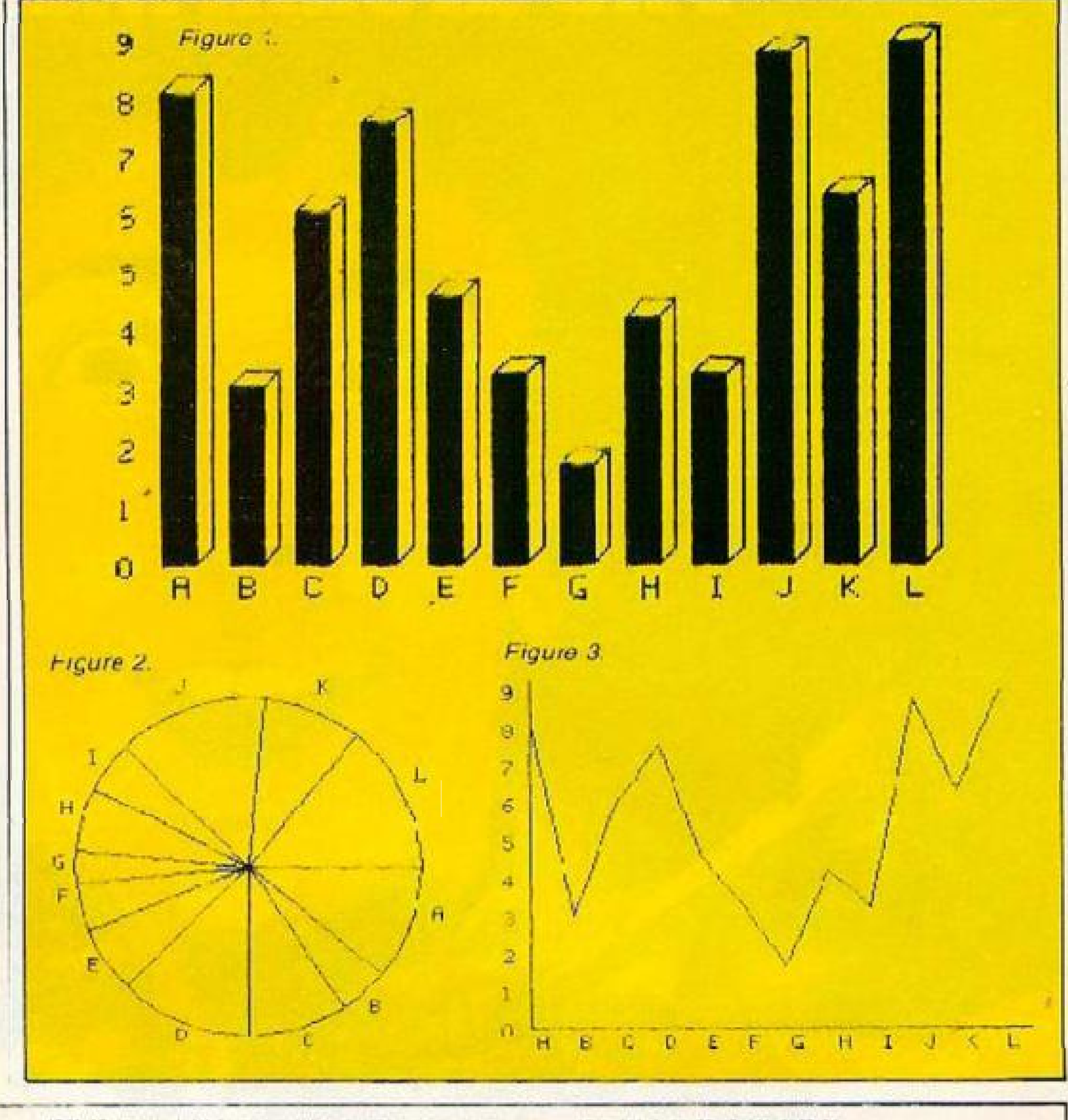
Numbers and letters are displayed on the high-resolution screen by means of a Draw statement. The position for the letters in the Draw statement of the pie chart is achieved by using the Circle command in the background colour and finishing at the mid-point of each segment so that the most recent point of each segment will be at the correct starting point for the Draw statement.

After each sub-program pressing the Z key will return you to the title page with the choice of further sub-programs.

```
10 PRINT"................................"
20 PRINT"...........STATISTICS..........."
30 PRINT"................................"
40 PRINT".........BY PATRICIA HILL........"
50 PRINT"................................"
60 FOR R= 1 TO 3000:NEXT R
70 CLS
80 LET S=0
90 PRINT @ 200, "INPUT TITLE"
100 INPUT T$
110 CLS
120 PRINT @ 192,"TOTAL NUMBER OF ENTRIES UP TO 12"
130 INPUT T
140 DIMA(T),B(T),A$(10),B$(12),C$(12)
150 FOR R= 1 TO T
160 CLS
170 PRINT"INPUT AMOUNT FOR ENTRY NO. ";R:INPUT A(R)
180 LINE INPUT "NAME OF ENTRY ";C$(R)
190 S=S+A(R)
200 NEXT R
```



```
210 CLS
220 REM SCALING FACTOR
230 E=A(1)
240 FOR R= 1 TO T-1
250 IF A(R+1)>E THEN E= A(R+1
260 NEXT R
270 F=INT(175/E)
280 REM PROPORTION OF TOTAL
290 FOR R = 1 TO T
300 B(R)=A(R)/S
310 IF B(R)<.01 THEN PRINTC$(R);:IF B(R)=0 THEN PRINT"W
ILL NOT SHOW ON THE PIE CHART  DUE TO A ZERO ENTRY"ELS
E PRINT"MAY NOT SHOW ON THE PIE CHART   DUE TO A LARG
E VARIENCE"
320 NEXT R
330 FOR G= 1 TO 3000:NEXT G:CLS
340 REM NUMBERS AND LETTERS
350 A$(0)="BR1R2E1U1H1L2G1D4U1BU1"
360 A$(1)="BR1R2L1U6H1L1BR4"
370 A$(2)="RAL4U1E2R1E1U1-1L2H1BU1"
380 A$(3)="BJ1F1R2E1U1H1L1R1E1U1H1L2G1BU1"
390 A$(4)="BR3U6G3D1F4BU4HL4"
400 A$(5)="R1U1F1R2F1U1H1L3U2R6L4"
410 A$(6)="BR1R2E1U1H1L2G2U3E2R2L2BL2"
420 A$(7)="BR1U2R3U1L4"
430 A$(8)="BR1R2E1U1H1L2G1D1U.E1R2E1U1H1L2G1D1L1BU1"
440 A$(9)="R2E2U3H1L2G1D1F1R2U2H1L2BL1"
450 B$(1)="U2R4D3U5H1L2G1D5U5BU1"
460 B$(2)="R3E1U.H1L3R3E1U1H1L3BL6"
470 B$(3)="BR1R2E1G1L2H1U4E1R2F1H1L2BL1"
480 B$(4)="R2E2U3H2L2D6U6"
490 B$(5)="R4L4U3R3L3U3R4L4"
500 B$(6)="U3R3L3U3R4L4"
510 B$(7)="BR1R3U2L1F1D2L3H1U4E1R3L3BR8"
520 B$(8)="U3R4D3U6D3L4U3"
530 B$(9)="BR1R2L1U6R1L2BL1"
540 B$(10)="BU1F1R2E1U5BL4"
550 B$(11)="U3R1F3H3E3D3L1U3"
560 B$(12)="R4L4U6"
570 PRINT @ 192,"DO YOU WANT A PRINTOUT Y/N"
580 INPUT A$
590 CLS
600 IF A$="Y" OR A$="N" THEN 610 ELSE 570
610 IF A$="N" THEN 680
620 C=40-(LEN(T$)/2)
630 PRINT#-2,CHR$(15);TAB(C);T$
640 FOR I= 1 TO LEN(T$)
650 PRINT#-2,TAB(C);"-";
660 NEXT R
670 PRINT#-2
680 PRINT@192,"TO REVERT TO TITLE PAGE ENTER Z"
690 FOR R= 1 TO 3000:NEXT R
700 C=16-(LEN(T$)/2)
710 REM TITLE PAGE
720 CLS
730 PRINT@C,T$
740 PRINT@ 137,"WHICH PROGRAM ?"
750 PRINT
760 PRINT"(1) PIE CHART"
770 PRINT"(2) MEAN, VARIENCE, STANDARD          DEVIATIO
N
780 PRINT"(3) PERCENTAGE CHART"
790 PRINT"(4) BAR GRAPH"
800 PRINT"(5) FREQUENCY POLYGON"
810 PRINT"(6) HISTOGRAM"
820 PRINT"(7) STOP"
830 INPUT P
840 ON P GO TO 850,1090,1260,1400,1560,1670,2090
850 REM PIE CHART
860 PMODE4,1:SCREEN1,0:PCLS
870 SP=0
880 O=0
890 FOR R= 1 TO T
900 O=SP
910 SP= SP+B(R)
920 CIRCLE(128,96),91,0,1,O,O+B(R)/2
930 X=PEEK(&HBD)*256+PEEK(&HBE)
940 Y=PEEK(&HBF)*256+PEEK(&HC0)
950 LINE(128,96)-(X,Y),PRESET
960 DRAWB$(R)
970 NEXT R
980 SP=0
990 FOR R= 1 TO T
1000 SP=SP+B(R)
1010 CIRCLE(128,96),92,1,1,0,SP
1020 X=PEEK(&HBD)*256+PEEK(&HBE)
1030 Y=PEEK(&HBF)*256+PEEK(&HC0)
1040 LINE(128,96)-(X,Y),PSET
1050 CIRCLE(128,96),92,1
1060 NEXT R
1070 IF A$="Y" THEN GO SUB 1800
1080 IF INKEY$="Z" THEN 720 ELSE 1080
1090 REM MEAN, VARIENCE, STANDARD DEVIATION
1100 B=0:M=S/T
1110 FOR R=1 TO T
1120 A=(A(R)-M)^2
1130 B=B+A
1140 NEXT R
1150 V=B/T:D=SQR(V)
1160 PRINT"MEAN = ";INT(M*100)/100
1170 PRINT
1180 PRINT"STANDARD DEVIATION = ";INT(D*100)/100
1190 PRINT
1200 PRINT"VARIENCE = ";INT(V*100)/100
1210 IF A$="N" THEN GO TO 1250
1220 PRINT#-2,CHR$(15);"MEAN = ";INT(M*100)/100
1230 PRINT#-2,"VARIENCE = ";INT(V*100)/100
1240 PRINT#-2,"STANDARD DEVIATION = ";INT(D*100)/100
1250 IF INKEY$="Z" THEN 720 ELSE 1250
1260 REM PERCENTAGE CHART
1270 PRINT"CODE NAME";TAB(20);"AMOUNT";TAB(29);"0/0
1280 FOR R= 1 TO T
1290 PRINT;CHR$(64+R);"=";C$(R);
1300 PRINTTAB(20);:PRINTUSING"####";A(R);
1310 PRINTTAB(28);:PRINTUSING"###.##";B(R)*100;
1320 NEXT R
```





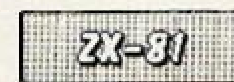
```
1330 IF A$="Y" THEN PRINT#-2,CHR$(15)"CODE NAME";TAB(
20);"AMOUNT";TAB(29);"PERCENTAGE"ELSE GO TO 1390
1340 PRINT#-2
1350 FOR R= 1 TO T
1360 PRINT#-2,CHR$(64+R);" = ";C$(R);
1370 PRINT# 2,CHR$(16)CHR$(20);:PRINT#-2,USING"####";A
(R);:PRINT#-2,CHR$(16)CHR$(21);:PRINT#-2,USING"###.##
";B(R)*100
1380 NEXT R
1390 IF INKEY$="Z" THEN 720 ELSE 1390
1400 REM BAR CHART
1410 PMODE4,1:SCREEN1,0:PCLS
1420 FOR R= 20 TO 20*T STEP 20
1430 LINE(R,180)-(R,180-F*A(R/20)),PSET
1440 DRAW"E5R10"
1450 LINE-(R+10,175),PSET
1460 LINE-(R+15,175-F*A(R/20)),PSET
1470 DRAW"G5L10R10"
1480 LINE-(R+10,180),PSET
1490 DRAW"NL10E5"
1500 PAINT(R+1,179)
1510 NEXT R
1520 GO SUB 1960
1530 GO SUB 2020
1540 IF A$="Y" THEN GO SUB 1860
1550 IF INKEY$="Z" THEN 720 ELSE 1550
1560 REM FREQUENCY POLYGON
1570 PMODE4,1:SCREEN1,0:PCLS
1580 FOR R=20 TO (20*(T-1))STEP 20
1590 LINE(R,180-F*A(R/20))-(R+20,180-F*A(R/20+1)),PSET
1600 NEXT R
1610 LINE(20,180)-(20,0),PSET
1620 LINE(20,180)-(256,180),PSET
1630 GO SUB 1960
1640 GO SUB 2020
1650 IF A$="Y" THEN GO SUB 1860
1660 IF INKEY$="Z" THEN 720 ELSE 1660
1670 REM HISTOGRAM
1680 PMODE4,1:SCREEN1,0:PCLS
1690 LINE(20,180)-(20,0),PSET
1700 LINE(20,180)-(256,180),PSET
```



```
1710 FOR R=20 TO (T*20) STEP 20
1720 IF A(R/20)=0 THEN 1770
1730 LINE(R,180)-(R,180-F*A(R/20)),PSET
1740 DRAW"R20"
1750 LINE-(R+20,180),PSET
1760 PAINT(R+1,179)
1770 NEXT R
1780 FOR R= 40 TO (T*20) STEP 20
1790 LINE(R,180)-(R,180-F*A(R/20)),PRESET
1800 NEXT R
1810 GO SUB 1960
1820 GO SUB 2020
1830 IF A$="Y" THEN GO SUB 1860
1840 IF INKEY$="Z" THEN 720 ELSE 1840
1850 REM DATA PRINTOUT
1860 PRINT#-2,CHR$(8)
1870 FOR Y= 0 TO 191 STEP 7
1880 FOR X= 0 TO 255
1890 A=PPOINT(X,Y)+PPOINT(X,Y+1)*2+PPOINT(X,Y+2)*4+PPO
INT(X,Y+3)*8+PPOINT(X,Y+4)*16+PPOINT(X,Y+5)*32+PPOINT(
X,Y+6)*64+128
1900 PRINT#-2,CHR$(A);
1910 NEXT X
1920 PRINT#-2,CHR$(13);
1930 NEXT Y
1940 PRINT#-2,CHR$(15)
1950 RETURN
1960 REM DRAW LETTERS
1970 DRAW"BM23,190"
1980 FOR R= 1 TO T
1990 DRAWB$(R)+"BR24BU6"
2000 NEXT R
2010 RETURN
2020 REM DRAW NUMBERS
2030 DRAW"BM6,184"
2040 FOR R= 0 TO 9
2050 DRAWA$(R)+"BU12"
2060 NEXT R
2070 RETURN
2080 REM END OF PROGRAM
2090 STOP
```

Trade

Llys Gwyn,
Boncath,
Dyfed.



TRADE IS A GAME for one to four players. The object of the game is to buy and sell goods and to make a profit. After the chosen number of turns has been completed, the player with the most money is the winner.

When the program is run the screen will be blank for a few seconds. When selecting the number of turns 10 is the minimum for a good game. When contracts is displayed it means that the port shown wishes to import the units of goods displayed.

When in port you may buy or sell goods or list information. Your ship has three holds each of which can take up to 500 units of any one type of goods. On selling each hold is considered individually. If you fulfil a contract you will make a profit; if you sell to a port you will make a slight loss. When at sea use N, E, S, W to move your ship while sailing.

D will display a ports location, C will permit passage through a canal and P will allow entry into port. Contracts and prices may change.

Randomly during a game at the end of the game the price of the ship will be included in the assessment.

```
   5 REM REYKJAVIK,FISH,79,145,L
IVERPOOL,MACHINERY,114,430,LENI
GRAD,IRON,117,155,STOCKHOLM,WOO
L,...,135,CAIRO,SILK,249,270
,BAHRAIN,OIL,285,130,CALCUTTA,JU
TE,290,140,CEYLON,TEA,355,155,TO
KYO,ELECTRICAL,229,316,CANBERRA,
MUTTON,392,155,
  10 REM LAGOS,COCOA,378,145,CAP
E TOWN,GOLD,546,650,JAMAICA,RUM
,271,195,BEUNOS AIRES,BEEF,504,1
0,DETROIT,CARS,171,345,NEW ORLEA
NS,COTTON,236,190,VANCOUVER,FRUI
T,134,155,MOMBASA,COFFEE,384,155
,SUEZ,,250,300,PANAMA,,336,300.
  15 FAST
  20 PRINT AT 10,8;"TRADE"
  25 LET A=16514
  30 DIM P$(20,12)
  35 DIM G$(20,10)
  40 DIM M(20)
  45 DIM C(20)
  50 FOR X=1 TO 20
  55 GOSUB 105
  60 LET P$(X)=A$
  65 GOSUB 105
  70 LET G$(X)=A$
  75 GOSUB 105
  80 LET M(X)=VAL A$
  85 GOSUB 105
  90 LET C(X)=VAL A$
```

(continued on page 177)

(continued from page 175)

```
  95 NEXT X
 100 GOTO 140
 105 LET A$=""
 110 LET B=PEEK A
 115 LET A=A+1
 120 IF A=16744 THEN LET A=16700
 125 IF B=26 THEN RETURN
 130 LET A$=A$+CHR$ B
 135 GOTO 110
 140 SLOW
 145 PRINT AT 13,3;"HOW MANY PLA
YERS? (1-4)"
 150 INPUT I
 155 LET I=INT I
 160 IF I<1 OR I>4 THEN GOTO 150
 165 PRINT AT 15,3;"HOW MANY TUR
NS?"
 170 INPUT J
 175 LET J=INT J
 180 IF J<1 THEN GOTO 170
 185 DIM V(I,30)
 190 FOR X=1 TO I
 195 LET V(X,30)=100
 200 LET V(X,1)=300000
 205 LET V(X,2)=INT (RND*18)+1
 210 LET V(X,3)=M(V(X,2))
 215 NEXT X
 220 DIM B(3,I+3)
 225 FOR X=1 TO I+3
 230 LET Y=INT (RND*18)+1
 235 LET E=INT (RND*18)+1
 240 IF Y=E THEN GOTO 230
 245 LET F=INT (RND*900)+100
 250 LET B(1,X)=Y
 255 LET B(2,X)=E
 260 LET B(3,X)=F
 265 NEXT X
 270 LET NO=I
 275 GOSUB 1130
 280 PRINT
 285 FOR Z=1 TO J
 290 PRINT "TIME ELAPSED ";Z-1
 295 PRINT "TIME LEFT ";J-Z+1
 300 FOR Y=1 TO NO
 305 PRINT "PRESS A KEY"
 310 IF INKEY$="" THEN GOTO 310
 315 IF V(Y,3)=0 THEN GOTO 780
 320 CLS
 325 PRINT "PLAYER  ",Y
 330 PRINT AT 3,0;"MONEY  £";V(Y
,1)
 335 PRINT AT 5,0;"YOU HAVE A SH
IP ";
 340 IF V(Y,2)=0 THEN PRINT "AT
SEA"
 345 IF V(Y,2)<>0 THEN PRINT "IN
 THE PORT OF ",P$(V(Y,2))
 350 IF V(Y,6)+V(Y,7)+V(Y,8)=0 T
HEN PRINT "YOU HAVE NO GOODS ABO
ARD"
 355 IF V(Y,6)+V(Y,7)+V(Y,8)=0 T
HEN GOTO 385
 360 PRINT AT 8,0;"ON BOARD YOU
HAVE:-"
 365 PRINT "GOODS","UNITS"
 370 FOR X=6 TO 8
 375 IF V(Y,X)<>0 THEN PRINT G$(
V(Y,X)),V(Y,X+3)
 380 NEXT X
 385 IF V(Y,2)=0 THEN GOTO 420
 390 PRINT AT 19,0;"DO YOU WISH
TO STAY IN PORT?"
 395 INPUT I$
 400 IF I$(1 TO 1)="Y" THEN GOTO
 795
 405 IF I$(1 TO 1)<>"N" THEN GOT
O 395
 410 LET V(Y,1)=V(Y,1)-200
 415 LET V(Y,2)=0
 420 LET E=INT (RND*10)+1
 425 PRINT "YOU HAVE ";E;" MOVES
"
 430 PRINT "PRESS N/L"
 435 INPUT I$
 440 LET PE=PEEK 16396+256*PEEK
16397
 445 GOSUB 1910
 450 FOR F=1 TO E
 455 LET G=PEEK (V(Y,3)+PE)
 460 POKE (V(Y,3)+PE),56
 465 LET M$=INKEY$
 470 IF M$="" THEN GOTO 465
 475 POKE V(Y,3)+PE,G
 480 IF M$<>"D" THEN GOTO 575
 485 CLS
 490 FAST
 495 FOR X=1 TO 20
 500 PRINT X,P$(X)
 505 NEXT X
 510 SLOW
 515 PRINT "ENTER NO."
 520 INPUT I
 525 LET I=INT I
 530 IF I<0 OR I>20 THEN GOTO 52
0
 535 GOSUB 1910
 540 LET H=PEEK (M(I)+PE)
 545 FOR X=1 TO 10
 550 POKE M(I)+PE,53
 555 POKE M(I)+PE,H
 560 NEXT X
 565 NEXT F
 570 GOTO 765
 575 IF M$<>"P" THEN GOTO 620
 580 FOR X=1 TO 18
 585 IF V(Y,3)=M(X) THEN GOTO 60
5
 590 NEXT X
 595 NEXT F
 600 GOTO 765
 605 LET V(Y,1)=V(Y,1)-(200+INT
(RND*100))
 610 LET V(Y,2)=X
 615 GOTO 795
 620 IF M$<>"C" THEN GOTO 650
 625 IF V(Y,3)=M(19)-33 THEN LET
 V(Y,3)=M(19)
 630 IF V(Y,3)=M(19)+33 THEN LET
 V(Y,3)=M(19)
 635 LET V(Y,3)=V(Y,3)-(V(Y,3)=M
(20)+1)+(V(Y,3)=M(20))
 640 LET V(Y,1)=V(Y,1)-400
 645 GOTO 760
 650 IF M$="N" AND V(Y,3)=M(19)+
33 THEN GOTO 760
 655 IF M$="S" AND V(Y,3)=M(19)-
33 THEN GOTO 760
 660 IF M$="E" AND V(Y,3)=M(20)
THEN GOTO 760
 665 IF M$="W" AND V(Y,3)=M(20)+
1 THEN GOTO 760
 670 LET DE=V(Y,3)-(M$="W")+(M$=
"E")-33*(M$="N")+33*(M$="S")
 675 IF DE/33=INT (DE/33) THEN L
ET DE=DE+(M$="E")-(M$="W")
 680 IF DE>725 THEN LET DE=DE-72
6
 685 IF DE<1 THEN LET DE=DE+726
 690 LET AD=PEEK (DE+PE)
 695 LET AV=G
 700 IF AD=128 THEN GOTO 745
 705 LET ZX=DE
 710 LET DE=AD
 715 LET AD=ZX
 720 IF M$="N" AND (DE=131 OR DE
=130 OR DE=129 OR AV=7 OR AV=132
 OR AV=3) THEN GOTO 745
 725 IF M$="S" AND (AV=131 OR AV
=130 OR AV=129 OR DE=7 OR DE=132
 OR DE=3) THEN GOTO 745
 730 IF M$="E" AND (AV=133 OR AV
=132 OR AV=129 OR DE=130 OR DE=7
 OR DE=5) THEN GOTO 745
 735 IF M$="W" AND (DE=133 OR DE
=132 OR DE=129 OR AV=130 OR AV=7
 OR AV=5) THEN GOTO 745
 740 GOTO 755
 745 NEXT F
 750 GOTO 765
 755 LET V(Y,3)=AD
 760 NEXT F
 765 CLS
 770 PRINT "THAT WAS THE LAST OF
 YOUR MOVES AND YOU ARE NOT IN P
ORT YET"
 775 GOTO 1500
 780 NEXT Y
 785 NEXT Z
 790 GOTO 1755
 795 CLS
 800 PRINT "PRESS A KEY"
 805 IF INKEY$="" THEN GOTO 805
 810 CLS
 815 PRINT "THIS IS THE PORT OF
",P$(V(Y,2))
 820 PRINT "GOODS AVAILABLE ";G$
(V(Y,2))
 825 PRINT "AT A COST OF £";C(V(
Y,2))
 830 PRINT AT 4,0;"YOU CAN DO TH
E FOLLOWING"
 835 PRINT AT 6,0;"1 BUY GOODS";
AT 8,0;"2 SELL GOODS";AT 10,0;"3
 DISPLAY CONTENTS OF SHIP";AT 12
,0;"4 PORT INFORMATION"
 840 PRINT AT 14,0;"5 LIST CURRE
NT CONTRACTS";AT 15,0;"6 REPAIRS
";AT 18,0;"7 END"
 845 LET LOSS=(100-RND*10)/100
 850 PRINT AT 21,0;"ENTER CHOICE
"
 855 INPUT I
 860 LET I=INT I
 865 CLS
 870 IF I<1 OR I>7 THEN GOTO 855
 875 IF I=1 THEN GOTO 915
 880 IF I=2 THEN GOTO 1210
 885 IF I=3 THEN GOTO 1075
 890 IF I=4 THEN GOTO 1175
 895 IF I=5 THEN GOSUB 1130
 900 IF I=6 THEN GOTO 1690
 905 IF I=7 THEN GOTO 775
 910 GOTO 800
 915 REM BUY
 920 LET AM=0
 925 FOR X=6 TO 8
 930 IF V(Y,X)>0 AND V(Y,X)<>V(Y
,2) THEN GOTO 940
 935 LET AM=AM+(500-V(Y,X+3))
 940 NEXT X
 945 IF AM=0 THEN PRINT "YOU HAV
E NO ROOM ON YOUR SHIP"
 950 IF AM=0 THEN GOTO 800
 955 PRINT "THERE IS ROOM FOR ";
AM;" UNITS"
 960 PRINT "YOU HAVE £";V(Y,1)
 965 PRINT "HOW MANY UNITS DO YO
U WISH TO   BUY AT £";C(V(Y,2));
" PER UNIT"
 970 INPUT I
 975 LET I=INT I
 980 LET LC=INT ((I*((10*RND)+5)
)/2)
 985 IF I<0 OR I>AM THEN GOTO 97
0
 990 IF I*C(V(Y,2))<=V(Y,1) THEN
 GOTO 1005
 995 PRINT "YOU CANNOT AFFORD TH
AT MUCH"
1000 GOTO 970
1005 LET V(Y,1)=V(Y,1)-(I*C(V(Y,
2)))
1010 FOR X=6 TO 8
1015 IF V(Y,X+3)=500 OR (V(Y,X)
<>0 AND V(Y,X)<>V(Y,2)) THEN GO
TO 1055
1020 IF I>(500-V(Y,X+3)) THEN GO
TO 1040
1025 LET V(Y,X+3)=V(Y,X+3)+I
1030 LET V(Y,X)=V(Y,2)
1035 GOTO 1060
1040 LET I=I-(500-V(Y,X+3))
1045 LET V(Y,X+3)=500
1050 LET V(Y,X)=V(Y,2)
1055 NEXT X
1060 PRINT "LOADING FEES £",LC
1065 LET V(Y,1)=V(Y,1)-LC
1070 GOTO 800
1075 IF V(Y,6)+V(Y,7)+V(Y,8)<>0
THEN GOTO 1090
1080 PRINT "THERE ARE NO GOODS O
N BOARD"
1085 GOTO 800
1090 PRINT "CONTENTS OF YOUR SHI
P"
1095 PRINT "HOLD GOODS","AMOUNT"
1100 FOR X=6 TO 8
1105 IF V(Y,X)=0 THEN GOTO 1120
1110 PRINT
1115 PRINT X-5,TAB 5,G$(V(Y,X)),
V(Y,X+3)
1120 NEXT X
1125 GOTO 800
1130 CLS
1135 PRINT "LIST OF CONTRACTS"
1140 PRINT "PORT";TAB 15;"IMPORT
";TAB 26;"AMOUNT"
1145 PRINT
1150 FOR X=1 TO NO+3
1155 PRINT P$(B(1,X));TAB 15;G$(
B(2,X));TAB 26;B(3,X)
1160 NEXT X
1165 IF I=5 THEN GOTO 800
1170 RETURN
1175 CLS
1180 PRINT "PORT               GOODS
    COST"
1185 PRINT "----               -----
    ----"
1190 FOR F=1 TO 18
1195 PRINT P$(F);TAB 14;G$(F),TA
B 26;C(F)
1200 NEXT F
1205 GOTO 800
1210 IF V(Y,6)+V(Y,7)+V(Y,8)<>0
THEN GOTO 1225
1215 PRINT "YOU HAVE NO CARGO FO
R SALE"
1220 GOTO 800
1225 PRINT "HOLD GOODS","AMOUNT"
1230 FOR X=6 TO 8
1235 IF V(Y,X)=0 THEN GOTO 1250
1240 PRINT
1245 PRINT X-5;TAB 5;G$(V(Y,X)),
V(Y,(X+3))
1250 NEXT X
1255 PRINT "ENTER HOLD NUMBER"
1260 INPUT I
1265 LET I=INT I
1270 IF I<1 OR I>3 THEN GOTO 126
0
1275 LET I=I+5
1280 IF V(Y,I)=0 THEN GOTO 1260
1285 PRINT "DO YOU WANT TO SELL
TO A          CONTRACT"
1290 INPUT I$
1295 IF I$(1 TO 1)="Y" THEN GOTO
 1365
1300 PRINT "ENTER QUANTITY"
1305 INPUT Q
1310 LET Q=INT Q
1315 IF Q<0 OR Q>V(Y,I+3) THEN G
OTO 1305
1320 IF I$(1 TO 1)="Y" THEN GOTO
 1430
1325 LET CO=INT (Q*C(V(Y,I))*LOS
S)
1330 PRINT "YOU GET ",CO
1335 LET V(Y,1)=V(Y,1)+CO
1340 LET V(Y,I+3)=V(Y,I+3)-Q
1345 IF V(Y,I+3)=0 THEN LET V(Y,
I)=0
1350 PRINT "LOADING FEES ";(Q*5)
1355 LET V(Y,1)=V(Y,1)-(Q*5)
1360 GOTO 800
1365 CLS
1370 PRINT "NO. PORT";TAB 16;"IM
PORT";TAB 26;"AMOUNT"
1375 FOR X=1 TO NO+3
1380 PRINT X;TAB 3;P$(B(1,X));TA
B 16;G$(B(2,X));TAB 28;B(3,X)
1385 NEXT X
1390 PRINT "ENTER CONTRACT NO."
1395 INPUT O
1400 LET O=INT O
1405 IF O<1 OR O>NO+3 THEN GOTO
1395
1410 IF B(1,O)<>V(Y,2) OR B(2,O)
<>V(Y,I) THEN GOTO 1420
1415 GOTO 1300
1420 PRINT "THE CONTRACT IS INVA
LID"
1425 GOTO 1285
1430 IF B(3,O)<Q THEN PRINT "THA
T MUCH IS NOT REQUIRED"
1435 IF B(3,O)<Q THEN GOTO 1305
1440 LET V(Y,I+3)=V(Y,I+3)-Q
1445 LET CO=Q*C(V(Y,I))*(2.1-LOS
S)
1450 LET CO=INT CO
1455 LET CO=CO-(Q*5)
1460 IF V(Y,I+3)=0 THEN LET V(Y,
I)=0
1465 PRINT "AFTER UNLOADING FEES
 YOU HAVE ","£";CO
1470 LET V(Y,1)=V(Y,1)+CO
1475 LET B(3,O)=B(3,O)-Q
1480 IF B(3,O)<>0 THEN GOTO 800
1485 LET I=0
1490 GOSUB 1550
1495 GOTO 800
1500 IF RND>.7 THEN GOSUB 1520
1505 IF RND>.95 THEN GOSUB 1545
1510 IF RND>.99 THEN GOSUB 1575
1515 GOTO 780
1520 FOR X=1 TO INT (RND*3+1)
1525 LET O=INT (RND*18+1)
1530 LET C(O)=INT (C(O)*((90+(RN
D*20))/100))
1535 NEXT X
1540 RETURN
1545 LET O=INT (RND*(NO+3)+1)
1550 LET B(1,O)=INT (RND*18)+1
1555 LET B(2,O)=INT (RND*18)+1
1560 IF B(1,O)=B(2,O) THEN GOTO
1550
1565 LET B(3,O)=INT (RND*900)+10
0
1570 RETURN
1575 IF V(Y,2)<>0 THEN RETURN
1580 PRINT "YOU ARE IN A STORM"
1585 IF V(Y,9)+V(Y,10)+V(Y,11)>1
00 THEN GOTO 1645
1590 PRINT "STRENGTH OF SHIP ";V
(Y,30)
1595 IF V(Y,30)<25 THEN PRINT "Y
OU COULD SINK"
1600 PRINT "DAMAGE SUSTAINED ";
1605 LET DAM=INT (RND*25)
1610 PAUSE 100
1615 PRINT DAM
1620 LET V(Y,30)=V(Y,30)-DAM
1625 IF V(Y,30)>=0 THEN RETURN
1630 PRINT "YOUR SHIP HAS SUNK Y
OU ARE OUT  OF THE GAME"
1635 LET V(Y,3)=0
1640 RETURN
1645 PRINT "IF YOU DUMP ALL YOUR
 CARGO YOU  WILL BE ABLE TO RIDE
 THE STORM  AND YOUR SHIP WILL N
OT BE          DAMAGED"
1650 PRINT "DO YOU WISH TO TAKE
THIS OPTION?"
1655 INPUT I$
1660 IF I$(1 TO 1)="N" THEN GOTO
 1590
1665 IF I$(1 TO 1)<>"Y" THEN GOT
O 1655
1670 FOR F=6 TO 11
1675 LET V(Y,F)=0
1680 NEXT F
1685 RETURN
1690 IF V(Y,30)=100 THEN PRINT "
YOU DO NOT NEED REPAIRS"
1695 IF V(Y,30)=100 THEN GOTO 80
0
1700 PRINT "YOU REQUIRE ";100-V(
Y,30);" REPAIRS","COST OF REPAIR
S £";100
1705 PRINT "ENTER REPAIRS"
1710 INPUT I
1715 LET I=INT I
1720 IF I<0 OR I>(100-V(Y,30)) T
HEN GOTO 1710
1725 IF V(Y,1)<I*100 THEN PRINT
"YOU CANNOT AFFORD THE REPAIRS"
1730 IF V(Y,1)<I*100 THEN GOTO 1
710
1735 LET V(Y,1)=V(Y,1)-100*I
1740 LET V(Y,30)=V(Y,30)+I
1745 PRINT "REPAIRS REQUIRED=";1
00-V(Y,30)
```

(continued on page 183)

BBC Hardware



A full colour 32K ROM computer with text and graphics modes up to 640 x 256 graphics and 80 column text screen, extended Microsoft basic, built in assembler 1 MHZ and tube interface, sideways ROM, RS 423, A/D converter.

BBC Model B £399

Electron

Son of BBC at selected Big dealers now!



Manufactured by the same company as the BBC, who have used their experience and knowledge to great effect to produce another winning computer. Many BBC programs are compatible with the Electron.

Electron £199

Memotech MTX Series



This new and very versatile computer is aimed at the lower end of the business market and the home computer enthusiast. Highly expandable disk drives which will be available early spring. The Memotech is able to take on many peripherals. Separate numeric key pad and functions key pad enabling fast data entry input. CPM compatible. **The Memotech comes in two different versions:**

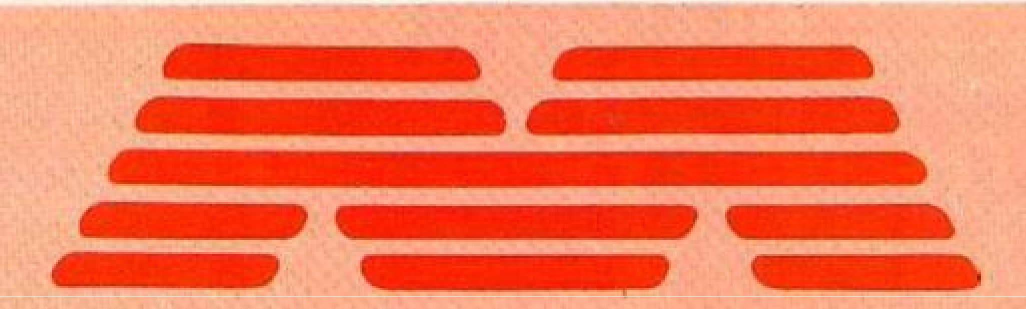
MTX500 32K of user RAM — £275
MTX512 64K of user RAM — £315

Atari 600XL



A fully expandable home computer. Ideal for the first time user. With cassette recorders, disk drives, printer, joysticks and other add-on peripherals. 2000 software titles readily available. All peripherals for the Atari 600XL are completely compatible with the Atari 400 and 800 machines already on the market.

16K £159.99
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123 Oxford Road
High Wycombe, Bucks
0494 442311

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Complet Computer Systems
112a North Street
Hornchurch, Essex
04024 46741

Horsham
Micro Store
13b West Street
Horsham, W. Sussex
0403 52297

Orchard Business Systems Ltd
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London
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Microns
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Earls Court
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45 Nicholsons Walk
Maidenhead
0628 31765

Marlow
Citybench
2/4 Eton Place
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Source Computers
4 Cross Lane
Newton-Le-Willows
Merseyside
092 524394

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12a Pottergate
Norwich
Norfolk
0603 614441

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South West Ind. Estate
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Durham
0783 850314

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Lancs
0772 561952

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Berkshire
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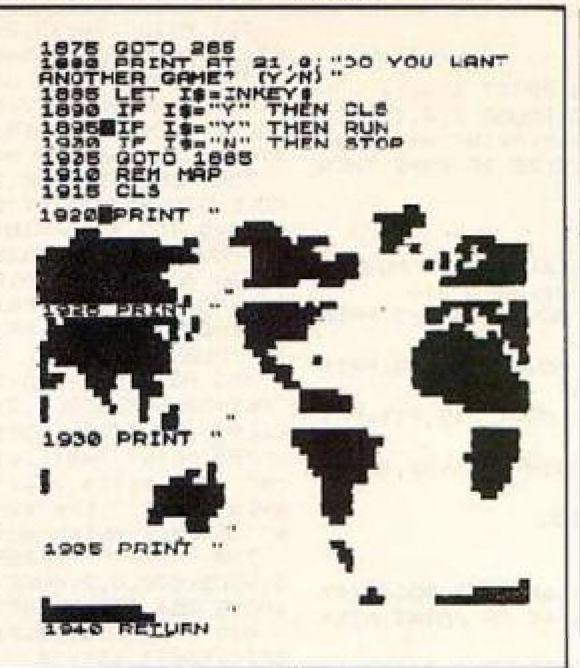
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(continued from page 177)

```
1750 GOTO 800
1755 PRINT "END OF GAME"
1760 FOR X=1 TO NO
1765 IF V(X,3)<>0 THEN LET V(X,1
3)=V(X,1)+150000
1770 IF V(X,3)=0 THEN GOTO 1795
1775 FOR F=6 TO 8
1780 IF V(X,F)=0 THEN GOTO 1790
1785 LET V(X,13)=V(X,13)+C(V(X,F
))*V(X,F+3)*.9
1790 NEXT F
1795 NEXT X
1800 CLS
1805 PRINT "RESULT AFTER ";J;" G
OES"
1810 FOR X=1 TO NO
1815 PRINT
1820 PRINT "PLAYER ";X
1825 PRINT "TOTAL=£";V(X,13)
1830 PRINT
1835 NEXT X
1840 PRINT AT 18,0;"DO YOU WISH
AN EXTENSION OF THISGAME?"
1845 INPUT I$
1850 IF I$(1 TO 1)="N" THEN GOTO
 1880
1855 IF I$(1 TO 1)<>"Y" THEN GOT
O 1845
1860 PRINT "HOW MANY EXTRA GOES?
"
1865 INPUT J
1870 CLS
1875 GOTO 265
1880 PRINT AT 21,0;"DO YOU WANT
ANOTHER GAME? (Y/N)"
1885 LET I$=INKEY$
1890 IF I$="Y" THEN CLS
1895 IF I$="Y" THEN RUN
1900 IF I$="N" THEN STOP
1905 GOTO 1885
1910 REM MAP
1915 CLS
```



Caterpillar

Richarch Arundale,
Leeds,
West Yorkshire.



CATERPILLAR is based on the popular arcade game Centipede. The caterpillar moves horizontally but drops down a line and changes direction whenever it reaches the edge of the screen or hits a mushroom. Your task is to kill off the caterpillar before it reaches the bottom of the screen and kills you.

The mushrooms can be destroyed by shooting them three times. Their colour changes according to the number of hits sustained — no hits — red, one hit — green, two hits — blue. However, spiders often spin down from their webs above the mushroom patch to drop more mushrooms. The spiders can be shot for bonus points, but do not get in their way — they are lethal.

A snail also joins in the fun, poisoning any mushrooms in its way. Both the snail and the poisoned mushrooms can be shot for bonus points, but if the caterpillar comes into contact with a poisoned mushroom it will die.

If you manage to shoot all the segments of the caterpillar then you move on to the next mushroom patch, which contains more mushrooms and all the usual creepy-crawlies and, of course, another caterpillar. You have three bugs with which to fight off the caterpillars.

When asked if you want instructions, type Y or N. However, the instructions are more of an introduction to the inhabitants of the mushroom patch than an explanation of the game.

The program allows the use of both keyboard and joysticks. Although you are not asked if you want to use joysticks, a check is made, so you can use either, and you can in fact change in the middle of a game. For those without joysticks, the Adval commands in Procmove and Procfire can be omitted. A word of warning for those with joysticks: make sure that the lever is centred when using the keyboard, otherwise the program will be responding to the joystick as well as the keyboard. The keyboard controls are Z to go left, X to go right, and Shift to fire.

The program itself is well-structured using procedures and the minimum number of Goto statements. The following is a list of procedures used and their main purpose.

PROCmove: moves the bug.
PROCfire: fires arrows and checks if they hit anything.
PROCcaterpillar: moves caterpillar.
PROCdown: moves caterpillar down a line.
PROCpest: checks what pest needs moving — snail or spider.
PROCsnail: moves snail and poisons any mushrooms it passes over.
PROCspider: moves spider and drops mushrooms.
PROCscreen: sets up screen display.
PROCclear: resets variables after clearing a screen.
PROCdead: checks if last score is a highscore, displays high-score table.
PROCinstructions: displays characters, instructions, and controls.
PROCinit: sets up variables and defines envelopes.
PROCchars: sets up user-defined characters.

```
   10 MODE2:PROCinit:PROCchars
   20 REPEAT:PROCinstructions
   30 REPEAT:PROCscreen
   40 REPEAT:PROCmove:PROCfire:PROCcaterpillar:PROCpes
t:UNTIL C% OR D%
   50 IF C% THEN PROCclear ELSE IF D% THEN PROCdead
   60 UNTIL L%=0:PROChiscores:UNTIL FALSE
   70 END
   80 DEFPROCmove
   90 IF (INKEY(-98) OR ADVAL(1) DIV 64>900) AND A%>63
 AND POINT(A%-32,16)=0 THEN MOVE A%,32:PRINT bug$:A%=A
%-64:MOVE A%,32:PRINT bug$:ENDPROC
  100 IF (INKEY(-67) OR ADVAL(1) DIV 64<200) AND A%<12
16 AND POINT(A%+96,16)=0 THEN MOVE A%,32:PRINT bug$:A%
=A%+64:MOVE A%,32:PRINT bug$:ENDPROC ELSE ENDPROC
  110 DEFPROCfire
  120 IF (INKEY(-1) OR (ADVAL(0) AND 1)=1) AND NOT F%
THEN F%=TRUE:BX%=A%:BY%=32:GCOL3,14:MOVE BX%,BY%:VDU 2
28:SOUND0,-10,6,1:J%=0:REPEAT:J%=J%+1:GOTO 140 ELSE IF
 NOT F% THEN ENDPROC
  130 J%=0:REPEAT:J%=J%-1:GCOL3,14:MOVE BX%,BY%:VDU228
:BY%=BY%+32:MOVE BX%,BY%:VDU228
  140 IF BY%>895 THEN MOVE BX%,BY%:VDU228:F%=FALSE:UNT
IL F%=FALSE:ENDPROC
  150 IF POINT(BX%+32,BY%+16)=1 THEN MOVE BX%,BY%:VDU2
28:MOVE BX%,BY%+32:PRINT RM$:MOVE BX%,BY%+32:PRINT GM$
:SOUND 0,-15,6,2:F%=FALSE:SC%=SC%+20:VDU4:PRINT TAB(6,
2);SC%:VDU5:UNTIL F%=FALSE:ENDPROC
  160 IF POINT(BX%+32,BY%+16)=2 THEN MOVE BX%,BY%:VDU2
28:MOVE BX%,BY%+32:PRINT GM$:MOVE BX%,BY%+32:PRINT BM$
:SOUND 0,-15,6,2:F%=FALSE:SC%=SC%+30:VDU4:PRINT TAB(6,
2);SC%:VDU5:UNTIL F%=FALSE:ENDPROC
  170 IF POINT(BX%+32,BY%+16)=4 THEN MOVE BX%,BY%:VDU2
28:MOVE BX%,BY%-32:PRINT BM$:SOUND 0,-15,6,2:F%=FALSE:
SC%=SC%+40:VDU4:PRINT TAB(6,2);SC%:VDU5:UNTIL F%=FALSE
:ENDPROC
  180 IF POINT(BX%+32,BY%+16)=10 THEN SOUND 2,2,140,1:
MOVE BX%,BY%:VDU228:MOVE BX%,BY%+32:PRINT spider$:F%=F
ALSE:P%=0:SC%=SC%+200:VDU4:PRINT TAB(6,2);SC%:VDU5:UNT
IL F%=FALSE:ENDPROC
  190 IF POINT(BX%+32,BY%+16)=11 THEN MOVE BX%,BY%:VDU
228:MOVE BX%,BY%+32:PRINT PM$:SOUND 0,-15,6,2:F%=FALSE
:SC%=SC%+100:VDU4:PRINT TAB(6,2);SC%:VDU5:UNTIL F%=FAL
SE:ENDPROC
  200 IF POINT(BX%+32,BY%+24)=14 THEN SOUND 1,2,150,1:
MOVE BX%,BY%:VDU228:MOVE BX%,BY%+32:PRINT snail$:P%=FA
LSE:F%=FALSE:SC%=SC%+500:VDU4:PRINT TAB(6,2);SC%:VDU5:
UNTIL F%=FALSE:ENDPROC
  210 IF POINT(BX%+32,BY%+16)<>5 THEN UNTIL J%=3:ENDPR
OC ELSE MOVE BX%,BY%:VDU228:K%=0:REPEAT:K%=K%+1:UNTIL
(SX%(K%)=BX% AND SY%(K%)=BY%+32)
  220 SOUND 1,2,100,1:MOVE SX%(S%),SY%(S%):PRINT C$:MO
VE SX%(S%),SY%(S%):PRINT RM$:SX%(S%)=0:SY%(S%)=0:S%=S%
-1:F%=FALSE:SC%=SC%+50:VDU4:PRINT TAB(6,2);SC%:VDU5:IF
 S%=0 THEN C%=TRUE:UNTIL F%=FALSE:ENDPROC ELSE UNTIL F
%=FALSE:ENDPROC
  230 DEFPROCcaterpillar
  240 MOVE SX%(S%),SY%(S%):PRINT C$:IF SY%(1)<32 THEN
D%=TRUE:ENDPROC
  250 IF S%>1 THEN FOR K%=S% TO 2 STEP -1:SX%(K%)=SX%(
K%-1):SY%(K%)=SY%(K%-1):NEXT
  260 SX%(1)=SX%(1)+SD%:IF POINT(SX%(1)+32,SY%(1)-16)=
-1 THEN PROCdown
  270 IF POINT(SX%(1)+32,SY%(1)-16)=1 OR POINT(SX%(1)+
32,SY%(1)-16)=2 OR POINT(SX%(1)+32,SY%(1)-16)=4 THEN P
ROCdown
  280 IF POINT(SX%(1)+32,SY%(1)-16)<>11 THEN 290 ELSE
MOVE SX%(S%),SY%(S%):PRINT C$:SX%(S%)=0:SY%(S%)=0:S%=S
%-1:SX%(1)=SX%(1)-SD%:MOVE SX%(1),SY%(1):PRINT C$:IF S
%=1 THEN C%=TRUE:ENDPROC ELSE ENDPROC
  290 IF POINT(SX%(1)+32,SY%(1)-16)=3 THEN MOVE SX%(1)
,SY%(1):PRINT C$:D%=TRUE:ENDPROC
  300 MOVE SX%(1),SY%(1):PRINT C$:ENDPROC
  310 DEFPROCdown
  320 SY%(1)=SY%(1)-32:SX%(1)=SX%(1)-SD%:SD%=-SD%
  330 IF POINT(SX%(1)+32,SY%(1)-16)=1 OR POINT(SX%(1)+
32,SY%(1)-16)=2 OR POINT(SX%(1)+32,SY%(1)-16)=4 THEN S
X%(1)=SX%(1)+SD%:GOTO 330
  340 ENDPROC
  350 DEFPROCpest
  360 IF P%=0 AND RND(100)=1 THEN P%=1:PX%=0:PY%=RND(6
```

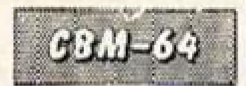
(continued on next page)

(continued from previous page)

```
)*64+192:SOUND 1,1,100,9:MOVE PX%,PY%:PRINT snail$
  370 IF P%=0 AND RND(50)=1 THEN P%=2:SOUND 2,4,175,1:
AX%=(RND(20)-1)*64:AY%=926:MOVE AX%,AY%:PRINT spider$
  380 IF P%=1 THEN PROCsnail:ENDPROC ELSE IF P%=2 THEN
 PROCspider:ENDPROC ELSE ENDPROC
  390 DEFPROCsnail
  400 MOVE PX%,PY%:PRINT snail$
  410 PX%=PX%+64:IF POINT(PX%+32,PY%-16)=1 THEN MOVE P
X%,PY%:PRINT RM$:MOVE PX%,PY%:PRINT PM$:GOTO 410
  420 IF POINT(PX%+32,PY%-16)=2 THEN MOVE PX%,PY%:PRIN
T GM$:MOVE PX%,PY%:PRINT PM$:GOTO 410
  430 IF POINT(PX%+32,PY%-16)=4 THEN MOVE PX%,PY%:PRIN
T BM$:MOVE PX%,PY%:PRINT PM$:GOTO 410
  440 IF POINT(PX%+32,PY%-16)=11 THEN MOVE PX%,PY%:PRI
NT PM$
  450 IF POINT(PX%+32,PY%-16)=-1 OR POINT(PX%+32,PY%-1
6)=5 THEN P%=FALSE:ENDPROC
  460 MOVE PX%,PY%:PRINT snail$:ENDPROC
  470 DEFPROCspider
  480 MOVE AX%,AY%:PRINT spider$
  490 AY%=AY%-32:IF POINT(AX%+32,AY%-16)=1 OR POINT(AX
%+32,AY%-16)=2 OR POINT(AX%+32,AY%-16)=4 OR POINT(AX%+
32,AY%-16)=11 THEN 490
  500 IF POINT(AX%+24,AY%-48)=14 THEN SOUND 2,2,140,1:
GCOL3,14:MOVE BX%,BY%:VDU228:F%=FALSE:P%=0:SC%=SC%+200
:VDU4:PRINT TAB(6,2);SC%:VDU5:ENDPROC
  510 IF POINT(AX%+32,AY%-16)=-1 THEN SOUND 2,0,0,0:P%
=0:ENDPROC
  520 IF POINT(AX%+32,AY%-16)=0 AND RND(5)=1 THEN MOVE
 AX%,AY%:PRINT RM$:GOTO 490
  530 IF POINT(AX%+32,AY%-16)=3 THEN D%=TRUE:ENDPROC
  540 MOVE AX%,AY%:PRINT spider$:ENDPROC
  550 DEFPROCscreen
  560 MOVE 0,1023:PRINT C$;C$;C$:MOVE 1088,1023:PRINT
C$;C$;C$:GCOL0,2:MOVE 310,1017:PRINT"CATERPILLAR":GCOL
0,3:MOVE 300,1023:PRINT"CATERPILLAR"
  570 VDU4:PRINT TAB(0,2);"SCORE ";SC%;TAB(12,2);"LIVE
S ";L%;TAB(0,3);"HIGH ";H%(1);TAB(12,3);"SHEET ";sheet
%:VDU5
  580 FOR K%=1 TO 35+sheet%:M%=(RND(20)-1)*64:N%=(27-R
ND(25))*32:MOVE M%,N%:PRINT RM$:NEXT
  590 MOVE A%,32:PRINT bug$:FOR K%=1 TO 12:MOVE SX%(K%
),SY%(K%):PRINT C$:NEXT
  600 ENDPROC
  610 DEFPROCclear
  620 SOUND 2,3,120,1:sheet%=sheet%+1:F%=FALSE:C%=FALS
E:D%=FALSE:P%=0:RESTORE 870:FOR K%=1 TO 12:READ SX%(K%
),SY%(K%):NEXT:S%=12:SD%=64
  630 CLS:ENDPROC
  640 DEFPROCdead
  650 SOUND 2,4,100,1:TIME=0:REPEAT UNTIL TIME>250:SOU
ND 2,0,0,0
  660 D%=FALSE:RESTORE 870:FOR K%=1 TO 12:READ SX%(K%)
,SY%(K%):NEXT:S%=12:SD%=64:L%=L%-1:F%=FALSE:P%=0
  670 CLS:ENDPROC
  680 DEFPROChiscores
  690 VDU4:IF SC%<=H%(5) THEN 710 ELSE PRINT TAB(5,3);
"A HI-SCORE":K%=0:REPEAT:K%=K%+1:UNTIL SC%>H%(K%):*FX1
5,1
  700 J%=5:REPEAT:H%(J%)=H%(J%-1):H$(J%)=H$(J%-1):J%=J
%-1:UNTIL J%=K%:H%(K%)=SC%:INPUT TAB(0,10)"Name ",H$(K
%):H$(K%)=LEFT$(H$(K%),8)
  710 CLS:VDU5:GCOL0,2:MOVE 320,928:PRINT"HI-SCORES":G
COL0,3:MOVE 312,932:PRINT"HI-SCORES":VDU4:FOR K%=1 TO
5:PRINT TAB(0,K%*4+4);K%;SPC(2);H%(K%);SPC(3);H$(K%):N
EXT
  720 PRINT TAB(2,20);"PRESS SPACE BAR":REPEAT UNTIL G
ET=32:CLS:VDU5:SC%=0:L%=3:A%=576:sheet%=1:ENDPROC
  730 DEFPROCinstructions
  740 VDU5:GCOL0,2:MOVE 266,515:PRINT"INSTRUCTIONS?":G
COL0,3:MOVE 256,519:PRINT"INSTRUCTIONS?":REPEAT:G$=GET
$:UNTIL G$="Y" OR G$="N":CLS:IF G$="N" THEN ENDPROC
  750 GCOL0,2:MOVE 310,986:PRINT"CATERPILLAR":GCOL0,3:
MOVE 300,991:PRINT"CATERPILLAR":MOVE 100,900:PRINT bug
$:MOVE 400,900:PRINT"BUG":MOVE 100,800:PRINT C$;C$;C$;
C$:MOVE 400,800:PRINT"CATERPILLAR"
  760 MOVE 100,700:PRINT snail$:MOVE 400,700:PRINT"SNA
IL":MOVE 100,600:PRINT spider$:MOVE 400,600:PRINT"SPID
ER":MOVE 100,500:PRINT RM$;GM$;BM$;PM$:MOVE 400,500:PR
INT"MUSHROOMS"
  770 MOVE 100,200:PRINT"PRESS SPACE BAR":REPEAT UNTIL
 GET=32:CLS:GCOL0,2:MOVE 266,954:PRINT"CATERPILLAR":G
COL0,3:MOVE 256,959:PRINT"CATERPILLAR":VDU4
  780 PRINT TAB(1,6);"Kill off the"''"caterpillar befo
re"''"it kills you."''''" Beware the spider"''"as it cr
awls down"''"the screen dropping"''"mushrooms , and th
e"''"snail which poisons"''"the mushrooms."
  790 PRINT'''"PRESS SPACE BAR":REPEAT UNTIL GET=32:CL
S:VDU5:GCOL0,2:MOVE 266,954:PRINT"CATERPILLAR":GCOL0,3
:MOVE 256,959:PRINT"CATERPILLAR":VDU4
  800 PRINT TAB(5,5);"CONTROLS";TAB(2,10);"Z            L
EFT";TAB(2,12);"X            RIGHT";TAB(2,14);"SHIFT
FIRE";TAB(3,20);"or  joysticks"''''"PRESS SPACE BAR":RE
PEAT UNTIL GET=32:CLS:VDU5:ENDPROC
  810 DEFPROCinit
  820 DIM SX%(12),SY%(12):RESTORE 870:FOR K%=1 TO 12:R
EAD SX%(K%),SY%(K%):NEXT
  830 DIM H%(5),H$(5):FOR K%=1 TO 5:H%(K%)=1000:H$(K%)
="B B C":NEXT
  840 A%=576:F%=FALSE:sheet%=1:S%=12:D%=FALSE:SD%=64:C
%=FALSE:SC%=0:L%=3:F%=0
  850 ENVELOPE 1,1,5,-5,-5,50,25,25,126,0,0,-5,126,0:E
NVELOPE 2,133,8,4,8,3,1,1,126,0,0,-10,126,0:ENVELOPE 3
,2,8,-1,-1,8,200,200,126,-1,-1,-1,126,10:ENVELOPE 4,8,
10,6,-1,0,0,255,109,-1,0,-1,126,126
  860 ENDPROC
  870 DATA 704,864,640,864,576,864,512,864,448,864,384
,864,320,864,256,864,192,864,128,864,64,864,0,864
  880 DEFPROCchars
  890 VDU23,224,0,24,52,60,110,122,0,0,0,23,225,0,0,8,
0,16,4,24,24
  900 RM$=CHR$18+CHR$3+CHR$1+CHR$224+CHR$8+CHR$18+CHR$
3+CHR$7+CHR$225:GM$=CHR$18+CHR$3+CHR$2+CHR$224+CHR$8+C
HR$18+CHR$3+CHR$7+CHR$225
  910 BM$=CHR$18+CHR$3+CHR$4+CHR$224+CHR$8+CHR$18+CHR$
3+CHR$7+CHR$225:PM$=CHR$18+CHR$3+CHR$11+CHR$224+CHR$8+
CHR$18+CHR$3+CHR$7+CHR$225
  920 VDU23,226,24,60,126,255,255,24,0,0,23,227,24,36,
66,165,129,195,66,66
  930 bug$=CHR$18+CHR$3+CHR$3+CHR$226+CHR$8+CHR$18+CHR
$3+CHR$2+CHR$227
  940 VDU23,228,0,16,56,16,16,16,16,0
  950 VDU23,229,0,0,24,255,255,24,66,66,23,230,0,24,10
2,0,0,102,90,66
  960 C$=CHR$18+CHR$3+CHR$5+CHR$229+CHR$8+CHR$18+CHR$3
+CHR$6+CHR$230
  970 VDU23,231,0,0,0,0,1,127,254,0,23,232,0,56,124,12
4,56,0,0,0
  980 snail$=CHR$18+CHR$3+CHR$9+CHR$231+CHR$8+CHR$18+C
HR$3+CHR$14+CHR$232
  990 VDU 23,233,0,130,124,214,254,124,84,130,23,234,0
,130,0,40,0,16,84,130
 1000 spider$=CHR$18+CHR$3+CHR$10+CHR$233+CHR$8+CHR$18
+CHR$3+CHR$12+CHR$234
 1010 ENDPROC
```

File saver

F D Rose,
Stoke Bishop,
Bristol



UNLIKE THE SPECTRUM with its Save Code command, the CBM-64 lacks the facility for saving a portion of memory from Basic. This program provides such a utility. It allows you to save any stretch of memory, specifying the start address, the finish address, file-name, device number, and secondary address. The device number will usually be 1 for tape saving or 8 for disc saving.

Once you have typed the program in run it and wait for it to Poke in a small machine-code routine. You will then be asked to specify addresses and device number. If you give 1 as your secondary address you can reload the file using Load; giving a secondary address of zero means that you will have to use the command Load "",1,1. To save a file whether it be data or a machine-code program simply enter SYS 49152.

```
1 INPUT"FILENAME";F$
2 F$=LEFT$(F$,8)
3 FORN=1 TO LEN(F$):POKE819+N,ASC(MID$(F$,N,1)):NEXT
4 INPUT"START ADDRESS";SA
5 INPUT"END ADDRESS";EA
6 INPUT"DEVICE NO.";DN
7 INPUT"SECONDRY ADDRESS";ES
8 II=49152
9 I=49152
10 READ A$
20 IF A$="-" THEN 200
30 AL$=LEFT$(A$,1):AR$=RIGHT$(A$,1)
40 IF ASC(AL$)<65 THEN D=VAL(AL$)*16:GOTO 60
50 D=(ASC(AL$)-55)*16
60 IF ASC(AR$)<65 THEN D=D+VAL(AR$):GOTO 80
70 D=D+ASC(AR$)-55
80 POKE I,D:I=I+1:GOTO 10
100 DATA A9,08,A2,08,A0,FF,20,BA,FF,A9,01,A2,34,A0,03,20,BD,FF,A9,FF,85,FE
110 DATA A9,FF,85,FC,A2,00,A0,FF,A9,FB,20,D8,FF,60,-
200 POKE II+3,DN:POKEII+5,ES
210 POKE II+10,LEN(F$)
220 A=INT(SA/256):POKEII+19,SA-A*256:POKEII+23,A
230 A=INT(EA/256):POKEII+27,EA-A*256:POKEII+29,A
```

Tape back-up

J Press,
Biggleswade,
Bedfordshire.



THIS MACHINE-CODE routine resides in the printer buffer and will allow back-up copies to be made of almost any program on both 16K and 48K versions of the Spectrum. The routine is compatible with the ZX Interface 1 and is easy to use.

Type in the program as listed and then enter Run. The program will Poke the machine code into place and will then save it to tape. If you have made a typing mistake, the message Sumcheck Error will be displayed, in which case you should check the Data statements for errors.

The cloning routine is loaded by entering:

LOAD "JPCLONE" CODE

Once the code has been loaded, either:

RANDOMISE USR 23296

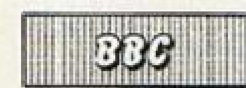
You will be presented with a menu of the three options available to you.

The program to be backed-up must be copied block by block — Spectrum programs usually consist of two or three data blocks, one of which may be headerless. Press 1 for a normal block — with a header — or 2 if the block is headerless. Put the program to be copied into the cassette recorder and start it playing. If option 1 was selected, the name of the block will be displayed. Once the block has been loaded the normal Start tape and press any key message will be displayed, you should then put the back-up tape into the recorder, start it recording and press any key on the Spectrum. When the block has been saved the menu will be redisplayed so that you can copy another data block or press 3 to return to Basic.

```
  5 LET a=0
  6 RESTORE 50
 10 FOR i=23296 TO 23296+238
 20 READ c: POKE i,c: LET a=a+c
 30 NEXT i
 35 PRINT ''a
 40 IF a<>22885 THEN  PRINT '"SUMCHECK ERROR": STOP
 45 SAVE "JPCLONE"CODE 23296,239
 50 DATA 62,2,205,1,22,6,22,205,68,14,17,184,91,1,55,0
 70 DATA 205,60,32,33,0,91,229,62,247,219,254,79,230
 90 DATA 1,40,12,121,230,2,40,66,121,230,4,32,237,225,201
110 DATA 62,49,205,166,91,175,55,221,33,239,91,17,17,0
120 DATA 205,2,8,58,239,91,17,192,9,205,10,12,1,10,0,17
150 DATA 240,91,205,60,32,55,62,255,237,91,250,91,221,42
160 DATA 10:,92,205,2,8,42,101,92
170 DATA 22:,33,239,91,195,112
180 DATA 9,62,50,205,166,91,55,62
190 DATA 255,221,42,101,92,17
200 DATA 255,239,205,86,5,221,229,225,237,91,101,92,175,237,82,
34
210 DATA 250,91,62,253,205,1,22,175,17,161,9,205,10,12,253,203
220 DATA 2,238,205,212,21,62,255,221,42,101,92,237,91,250,91,19
5
230 DATA 194,4,215,1,8,0,17,176,91,195,60,32
240 DATA 22,1,0,6,6,22,0,0,22,3,0,127,74,80,39,56,52,13,49,45
250 DATA 78,79,82,77,65,76,32,67,79,80,89,13,50,45,72,69,65,68,
69,82,76,69,83,83
260 DATA 32,67,79,80,89,13,51,45,69,78
270 DATA 58,13,79,80,84,73,79,78,63
```

3D graph program

Robert Driver,
Leeds,
West Yorkshire.



HERE IS A 3D-Graph program which will run on a 16K or 32K BBC Micro. It will plot any section of any function for Y in terms of X and Z as a wire-frame or surface diagram with or without axes — the axes option is only offered if the chosen values for X and Z include the origin.

In the menu, the last function for Y, values for X and Z etc. are shown and can be left unaltered simply by pressing Return, or changed by typing in the new value. All the expressions are entered as strings and then EVALed. This is especially useful for trigonometrical functions where the values for X and Z may need to be interms of PI e.g., -2*PI.

The menu is virtually foolproof: it will not accept a highest value for X lower than the lowest value for X. However, make sure that your function for Y is in terms of X and Z, and that there is no possibility of division by zero. There is an error-handling routine, but it is rather annoying to come and see how your wonderful graph is coming along, only to find that there was something wrong with the function.

The graph is then scaled by Procscale which usually does its job, but for extra-special graphs some fiddling around may be called for: YTALL is the height of the origin above the bottom of the screen, and YBIG is the number of graphics units per Y unit.

The graph is then plotted in mode 4 by Procplot. This procedure calls various other procedures according to whether a wire-frame or surface diagram is called for, and whether axes are wanted. Basically it calls Procline or Procaxisline from within a loop, which in turn call Procfill or Procsquare from within a loop.

If required the graph can be dumped up to nine times on to a printer by Procdump. This was written for a Seikosha GP-250X but it should run on any Seikosha or Acorn graphics printer with perhaps a little modification. The VDUs at the beginning are to specify linefeed and graphics mode, and to print lots of spaces so that the graph is printed in the middle of the paper. Then the graph is plotted sideways. This is because a byte of screen memory represents a row of eight pixels, whereas a byte sent to the printer is printed as a column of eight dots.

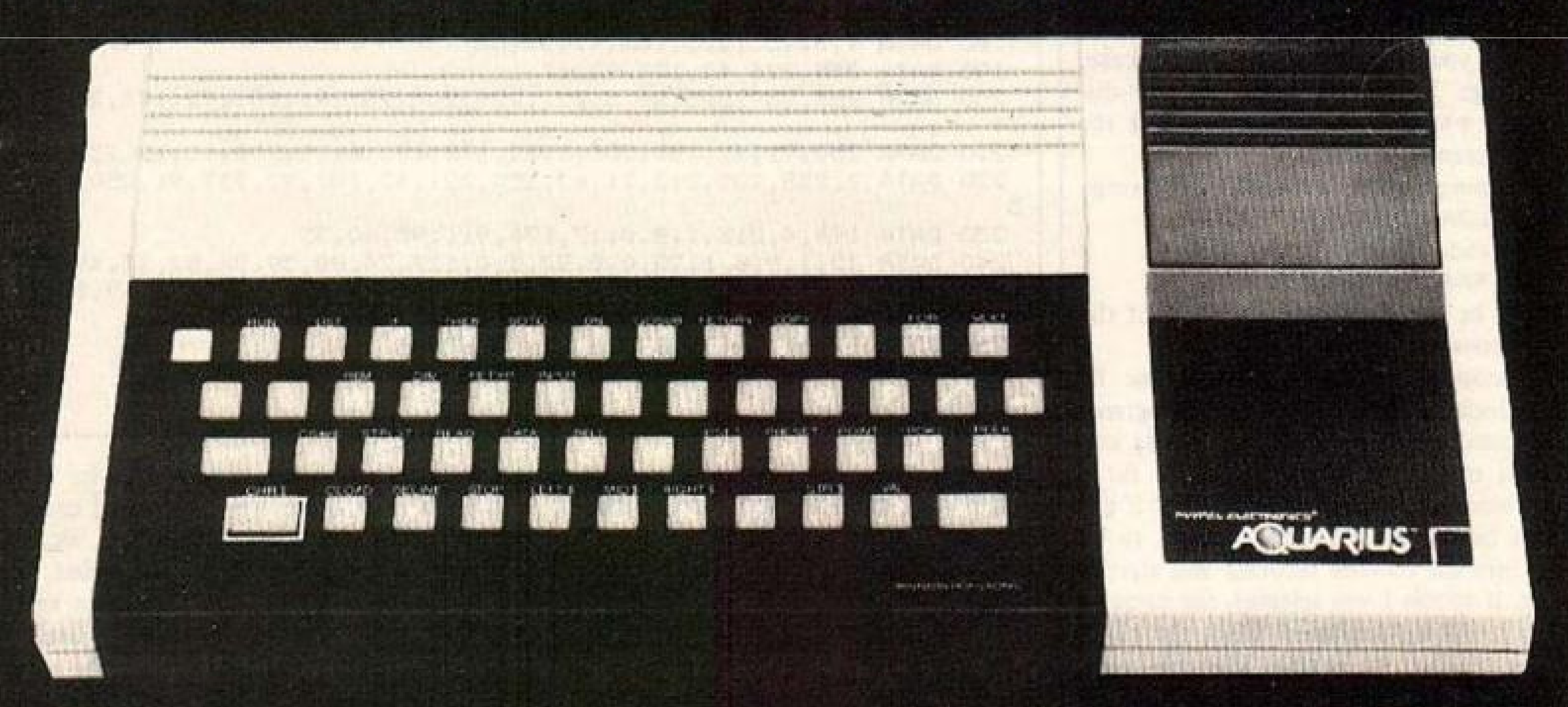
```
   10REM ********************
   20REM *                  *
   30REM *     3D-GRAPH     *
   40REM *    WRITTEN BY    *
   50REM * ROBERT  DRIVER   *
   60REM * COPYRIGHT 1984   *
   70REM *                  *
   80REM ********************
   90:
  100:
  110ON ERROR GOTO 1360
  120MODE7
  130PROCINIT
  140REPEAT:REM                MAIN
  150MODE7
  160PROCINPUT:REM            PROGRAM
  170PROCSCALE
  180MODE4:REM                CONTROL
  190PROCPLOT
  200UNTIL FALSE:REM           LOOP
  210END
  220:
  230:
  240DEF PROCINPUT
  250VDU23,1,1;0;0;0;
  260PRINT"EXPRESSION FOR Y IN TERMS OF X AND Z:":PRIN
TCHR$134;E$
  270INPUTA$:IF A$<>""THEN X=0:Z=0:Y=EVAL(A$):E$=A$
  280PRINT"LOWEST VALUE FOR X:",CHR$134;LX$:INPUTA$:IF
 A$<>""THEN LX$=A$
  290PRINT"HIGHEST VALUE FOR X:",CHR$134;HX$
  300INPUTA$:IF A$<>""THEN HX$=A$
  310IF EVAL(LX$)>=EVAL(HX$)THEN FOR J=1 TO 35-LEN(HX$
):VDU127:NEXT:GOTO300
  320PRINT"LOWEST VALUE FOR Z:",CHR$134;LZ$:INPUTA$:IF
 A$<>""THEN LZ$=A$
  330PRINT"HIGHEST VALUE FOR Z:",CHR$134;HZ$
  340INPUTA$:IF A$<>""THEN HZ$=A$
  350IF EVAL(LZ$)>=EVAL(HZ$)THEN FOR J=1 TO 35-LEN(HZ$
):VDU127:NEXT:GOTO340
  360PRINT"NUMBER OF STEPS ALONG X-AXIS:",CHR$134;XS$:
INPUTA$:IF A$<>""THEN XS$=A$
  370PRINT"NUMBER OF STEPS ALONG Z-AXIS:",CHR$134;ZS$:
INPUTA$:IF A$<>""THEN ZS$=A$
  380PRINT"DO YOU WANT A WIRE FRAME OR SURFACE" "DIAGR
AM",CHR$134;F$, A$=GET$:IF A$="W"OR A$="S" THEN F$=A$:
PRINT F$
  390XSTART=EVAL(LX$):XSTOP=EVAL(HX$):ZSTART=EVAL(HZ$)
:ZSTOP=EVAL(LZ$):XSTEP=(XSTOP-XSTART)/ABS(EVAL(XS$)):Z
STEP=(ZSTART-ZSTOP)/ABS(EVAL(ZS$))
  400IF(XSTART<=0 AND XSTOP>=0)OR(ZSTART>=0 AND ZSTOP<
=0) THEN PRINT"DO YOU WANT AXES (Y/N)",CHR$134;a$;:A$=
GET$:IF A$="Y"OR A$="N" THEN a$=A$:PRINT a$ ELSE a$="N
"
  410 PRINT"PLEASE WAIT. WHEN THE GRAPH IS FINISHED PR
ESS THE APPROPRIATE KEY FOR THE        NUMBER OF TIMES
YOU WANT IT TO BE         PRINTED, OR ANY NON-NUMERIC KE
Y TO       RETURN TO THIS MENU."
  420ENDPROC
  430:
  440:
  450DEF PROCSCALE
  460XSTART=XSTEP*((XSTART*100) DIV (XSTEP*100)):XSTOP
=XSTEP*((XSTOP*100) DIV (XSTEP*100)):ZSTART=ZSTEP*(((Z
START*100) DIV (ZSTEP*100)):ZSTOP=ZSTEP*((ZSTOP*100) DI
V (ZSTEP*100))
  470 ZBIG=1280/((ZSTART-ZSTOP)*2*(XSTOP-XSTART)):XTAL
L=(2*XSTART-ZSTOP)*ZBIG:X=XSTART:Z=ZSTART:YLARGE=EVAL(
E$):YSMALL=YLARGE:ZYLARGE=ZSTART:ZYSMALL=ZSTART
  480 FOR Z=ZSTOP TO ZSTART STEP ZSTEP
  490 FOR X=XSTART TO XSTOP STEP XSTEP:Y=EVAL(E$):IF Y
>=YLARGE THEN YLARGE=Y:ZYLARGE=Z
  500 IF Y<YSMALL THEN YSMALL=Y:ZYSMALL=Z
  510 NEXT:NEXT:YBIG=(1023-((ZYLARGE-ZYSMALL)*ZBIG))/(
YLARGE-YSMALL):YTALL=-YSMALL*YBIG-ZYSMALL*ZBIG:YBIG=2*
YBIG/3
  520ENDPROC
  530:
  540:
  550DEF PROCPLOT
  560VDU29,-XTALL;YTALL;
  570VDU23,1,0;0;0;0;
  580IF a$="Y" AND F$="S" THEN PROCAXISGRAPH ELSE PROC
GRAPH:IF a$="Y" THEN PROCaxes
  590A=GET-48:IF A>0 AND A<10 THEN PROCDUMP(A)
  600ENDPROC
  610:
  620:
  630DEF PROCGRAPH
  640FOR Z=ZSTART TO ZSTOP+ZSTEP STEP -ZSTEP
  650PROCLINE(Z):NEXT:MOVEFNX(XSTART,ZSTOP),FNY(XSTART
,ZSTOP)
  660FOR X=XSTART+XSTEP TO XSTOP STEP XSTEP:DRAWFNX(X,
ZSTOP),FNY(X,ZSTOP):NEXT
  670ENDPROC
  680:
  690:
  700DEF PROCAXISGRAPH
  710MOVEZBIG*ZSTART,ZBIG*ZSTART:DRAW2000,2000
  720IF ZSTART>0 THEN FOR Z=ZSTART TO ZSTEP STEP -ZSTE
P:PROCAXISLINE(Z):NEXT
  730MOVE-2000,0:DRAW2000,0:MOVE0,-2000:DRAW0,2000
  740IF ZSTOP<0 THEN FOR Z=0 TO ZSTOP+ZSTEP STEP -ZSTE
P:PROCAXISLINE(Z):NEXT
  750MOVEFNX(XSTART,ZSTOP),FNY(XSTART,ZSTOP):FOR X=XST
ART+XSTEP TO XSTOP STEP XSTEP:DRAWFNX(X,ZSTOP),FNY(X,Z
STOP):NEXT:MOVEZBIG*ZSTOP,ZBIG*ZSTOP:DRAW-2000,-2000
  760ENDPROC
  770:
  780:
  790DEF PROCDUMP(A)
  800FOR T=1 TO A
  810VDU2,1,27,1,76,1,2
  820FOR LX%=312 TO 0 STEP -8:VDU1,28,1,80,1,0,1,27,1,7
1,1,1,1,256
  830FOR CX%=0 TO 9920 STEP 320:FOR B%=HIMEM+LX%+CX% TO H
IMEM+LX%-CX%+7:VDU1,?B%:NEXT:NEXT
  840VDU1,10:NEXT:VDU1,15,27,1,76,1,3,1,10
  850FOR J%=1 TO (80-LEN(E$)) DIV 2:VDU1,32:NEXT:FOR J
%=1 TO LEN(E$):VDU1,ASC(MID$(E$,J%,1)):NEXT:VDU1,10,1,
10,3:NEXT
  860ENDPROC
```

(continued on page 187)

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```
  870:
  880:
  890DEF PROCSQUARE(X,Z)
  900MOVEFNX(X,Z),FNY(X,Z):DRAW FNX(X,Z-ZSTEP),FNY(X,Z
-ZSTEP):MOVEFNX(X,Z),FNY(X,Z):DRAWFNX(X+XSTEP,Z),FNY(X
-XSTEP,Z)
  910ENDPROC
  920:
  930:
  940DEF PROCFILL(X,Z)
  950MOVEFNX(X,Z),FNY(X,Z):MOVEFNX(X-XSTEP,Z),FNY(X+XS
TEP,Z):GCOL 0,0:PLOT85,FNX(X+XSTEP,Z-ZSTEP),FNY(X+XSTEP
,Z-ZSTEP):MOVEFNX(X,Z-ZSTEP),FNY(X,Z-ZSTEP):PLOT85,FNX
(X,Z),FNY(X,Z):GCOL0,1:DRAW FNX(X,Z-ZSTEP),FNY(X,Z-ZST
EP)
  960MOVEFNX(X,Z),FNY(X,Z):DRAWFNX(X-XSTEP,Z),FNY(X+XS
TEP,Z)
  970ENDPROC
  980:
  990:
 1000DEF PROCLINE(Z)
 1010FOR X=XSTART TO XSTOP-XSTEP STEP XSTEP
 1020IF F$="S" THEN PROCFILL(X,Z) ELSE PROCSQUARE(X,Z)
 1030NEXT:DRAWFNX(XSTOP,Z-ZSTEP),FNY(XSTOP,Z-ZSTEP)
 1040ENDPROC
 1050:
 1060:
 1070DEF PROCAXISLINE(Z)
 1080IF XSTART<0 THEN FOR X=XSTART TO -XSTEP STEP XSTE
P:PROCFILL(X,Z):NEXT
 1090MOVEZBIG*Z,ZBIG*Z:DRAWZBIG*(Z-ZSTEP),ZBIG*(Z-ZSTE
P)
 1100IF XSTOP>0 THEN FOR X=0 TO XSTOP-XSTEP STEP XSTEP
:PROCFILL(X,Z):NEXT
 1110MOVEFNX(XSTOP,Z),FNY(XSTOP,Z):DRAWFNX(XSTOP,Z-ZST
EP),FNY(XSTOP,Z-ZSTEP)
 1120ENDPROC
 1130:
 1140:
 1150DEF PROCaxes
 1160MOVE-2000,0:DRAW2000,0:MOVE-2000,-2000:DRAW2000,2
000:MOVE0,-2000:DRAW0,2000
 1170ENDPROC
 1180:
 1190:
 1200DEF PROCINIT
 1210FOR ZZ=1 TO 2:PRINTCHR$141;"                3D-GRA
PH":NEXT
 1220PRINT
 1230PRINT"  This program will plot a two-           dim
ensiona  representation of a three- dimensional graph
. It will also print   the graph up to nine times on a
 printer.There is a demonstration graph in the"
 1240PRINT"program, which you can see by pressing  RET
URN after each section in the menu.  The computer will
 then use the values   which are flashing. If you want
 to use  your own values, you simply type them in"
 1250VDU11:PRINT"in the appropriate places. Your value
s  will then override the flashing ones, so the next ti
me the menu appears you can  decide for each one wheth
er to change itor leave it as it is."
 1260PRINT"  The only problem with this program is tha
t it takes rather a long time.        especially if you
 use a large number of steps, which is necessary if yo
u want anattractive graph."
 1270E$="COS(SQR(X*X+Z*Z))/(SQR(X*X-Z*Z)+2)":LX$="-2*P
I":HX$="2*PI":LZ$="-2*PI":HZ$="2*PI":XS$="24":ZS$="24"
:F$="S":a$="N"
 1280PRINT"                     PRESS ANY KEY":A$=GET$
 1290ENDPROC
 1300:
 1310:
 1320DEF FNX(X,Z)=Z*ZBIG+X*XBIG+Z
 1330DEF FNY(X,Z)=Z*ZBIG+YBIG*EVAL(E$)
 1340:
 1350:
 1360REM *** ERROR HANDLING ROUTINE ****
 1370IF ERR>17 THEN MODE7:PRINT"THERE IS SOMETHING WR
ONG WITH THE        EQUATION YOU HAVE ENTERED. PLEASE C
HECK IT AND TRY AGAIN.":A=GET
 1380GOTO140
 1390:
 1400REM ********************************
```

Vic-20 auto line numbering.

```
10 DATA 169,40,133,3,133,2,133,3
20 DATA 133,4,169,49,133,1,120,169
30 DATA LB,141,20,3,169,HB,141,21
40 DATA 3,88
50 DATA 96,165,211,201,1,208,6,169
60 DATA 32,197,197,240,3,76,191,234
70 DATA 169,0,133,211,169,48,162,4
80 DATA 213,0,208,5,202,224,255,208
90 DATA 247,232,134,198,160,0,136,181
100 DATA 0,153,119,2,200,202,224,255
110 DATA 208,245,230,198,169,32,153,119
120 DATA 2,162,1,246,0,169,58,213
130 DATA 0,208,9,169,48,149,0,232
140 DATA 224,5,208,239,76,191,234
150 Z=0
151 T=PEEK(55)+256*PEEK(56)
152 T=T-105:LB=(T/256-INT(T/256))*256:HB=INT(T/256)
153 POKE55,LB:POKE56,HB
154 LB=LB+27:IFLB>255THENLB=LB-256:HB=HB-1
160 FOR X=T TO T+104
170 READ Y$
172 IF Y$="HB" THEN Z=Z+HB:POKEX,HB:NEXT
174 IF Y$="LB" THEN Z=Z+LB:POKEX,LB:NEXT
176 Y=VAL(Y$):Z=Z+Y:POKEX,Y
180 NEXT X
190 IF Z<>13063+LB+HB THEN PRINT "ERROR IN DATA -
    PLEASE RE-ENTER":END
200 PRINT "SYS(";T;") TO START"
210 PRINT "SYS(";T+3;") OR RUN-  STOP/RESTORE TO END"
220 PRINT "SYS(";T+14;") TO RESUME"
230 SYS(T)
240 NEW
```

CBM-64 auto line numbering.

```
10 DATA 169,48,133,2,133,4,133,5
20 DATA 133,6,169,49,133,3,120,169
30 DATA 27,141,20,3,169,192,141,21
40 DATA 3,88
50 DATA 96,165,211,201,1,208,6,169
60 DATA 60,197,197,240,3,76,49,234
70 DATA 169,0,133,211,169,48,162,4
80 DATA 213,2,208,5,232,224,255,208
90 DATA 247,232,134,198,160,0,136,181
100 DATA 2,153,119,2,200,202,224,255
110 DATA 208,245,230,198,169,32,153,119
120 DATA 2,162,1,246,2,169,58,213
130 DATA 2,208,9,169,48,149,2,232
140 DATA 224,5,208,239,76,49,234
150 Z=0
160 FOR X=49152 TO 49256
170 READ Y:Z=Z+Y:POKEX,Y
180 NEXT X
190 IF Z<>13045 THEN PRINT "ERROR IN DATA - PLEASE RE-ENTER":END
200 REM ** SYS (49152) TO START **
210 REM ** SYS (2048) OR RUN-STOP/RESTORE TO END
220 REM ** SYS (49166) TO RESUME **
230 SYS (49152)
240 NEW
```

Auto Number

*Clifford Miller,
Orlando,
Florida,
U.S.A.*



I FOUND GERALD DALY'S program in the November, 1983 issue of *Your Computer* for automatic line numbering on the Vic-20 very useful. However, I was unhappy to find that the program was designed for an unexpanded Vic. If it were to be run on a Vic-20 with memory expansion, all of the extra RAM would be lost.

I have modified Mr Daly's program to be used on a Vic-20 with any amount of memory expansion. The routine is stored at the top of RAM and the additional memory is preserved. The program runs exactly like Mr. Daly's except that the SYS commands to be used for the amount of RAM present are printed on the screen. Also since the start of Basic varies as the Vic-20 is expanded, it may be necessary to SYS to a location other than 4096 when interrupting the routine so that the system will not crash.

This same program will also run on the Commodore 64 with minor modifications. To enable automatic line numbering on the 64, type SYS(49152). It can be disabled by a SYS(2048) or by hitting Run-Stop/Restore. Resume with a SYS(49166)

To use either of these versions of Auto Number, load the program, type Run, and hit Return. To call a new line number, hit the space bar while the cursor is in the first column of a line, just as you would in the original program.

Function Keys

*Robert Young,
Chichester,
Sussex.*



THE SPECTRUM DOES NOT have a function key facility, and so I have written a machine-code program which allows any number of keys to be programmed very easily. This includes all the legends on the keys, the graphic symbols and the user-defined graphics, so that, for instance, the Print token can be programmed separately to the P and Tab. Of course, you will only wish to define keys you are unlikely to use for their normal

(continued on next page)

(continued from previous page)

purpose.

The definitions of keys should be put in separate Rem statements at the very beginning of the program. You should follow the line number and Rem by the symbol you wish to program, a colon, and then the definition. The definition can be any combination of characters, graphics and legends. If you want it to execute automatically then end it with the hash — # — character. If a syntax error is found when the line is executed, the line will be displayed at the bottom of the screen with a question mark as normal. Note that a key whose definition is just a hash, will act as an enter key.

The colon that must be put between the key to be defined and the definition not only conveniently separates the two but also puts the computer into K mode. If, however, you wish to start the definition with a letter of the alphabet which cannot be accessed in this mode, it is necessary to type any token or symbol that puts the computer into L mode, such as a keyword, then to type the character you want and finally to go back and delete whatever you used.

Rather than search through the whole program for key definitions, the program stops looking as soon as it finds the first proper program line. Therefore all the definitions must be put before the main program. This can be quite useful if you want a key which has been programmed to revert to its normal purpose temporarily.

Rather than deleting the definition all you need to do is change its line number so that it is, for instance, at the end of the program. Then at a later date you can change it back again. Lastly if a key is defined twice, it is the definition nearest the beginning of the program that will be taken. Note that a programmed key will repeat if held down.

The machine code is included in the data statements of the Basic program. The ninth figure of each statement is, however, the sum of the first eight and this is used by the program to check for errors in the data. Enter the Basic program, save it just to be on the safe side, and then run it. If an error is found the program will display the message Error In Line, followed by the line in which the error occurred. Note that the Basic program automatically alters the machine code if you have a 48K Spectrum, so that it is located at the top of memory — the actual data given is for the 16K model.

The program will then display Prepare To Save and the normal message will appear at the bottom of the screen. You may then save the machine code. After this it will print Prepare To Verify. Rewind the tape to the point where you started saving the code and the program will verify it automatically. If this is completed successfully, the Basic program will New itself leaving the machine code located at address 32348 for 16K machines or 65129 for 48K. In future, to load the machine-code, type

CLEAR 32347

for the 16K or

CLEAR 65128

for the 48K, followed by

LOAD "" CODE

The program must be turned on before it will work. This is done by:

"RANDOMIZE USR 32479" (16K)

or

"RANDOMIZE USR 65260" (48K)

To turn it off type:

"RANDOMIZE USR 32486" (16K)

or

"RANDOMIZE USR 65267" (48K)

Here are a few examples of key definitions

```
1 REM !: PAPER 7: INK 0: CLS: BORDER 7
#
2 REM .: PRINT 65536 - USR 7962#
3 REM NEW: INPUT A$: IF A$ = "Y" THEN
NEW #
4 REM ■:,
```

Rem 1 will reset all the colours — white paper and border, black ink — at a press of symbol shift — 1. This is useful if you are developing a program using a strange combination of colours. Often, after stopping such a program, the listing is almost unreadable.

Rem 2 will print out how much free memory you have left on typing a full-stop.

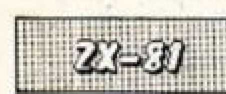
Rem 3 is a safeguard against Newing a program accidentally. On pressing New, you must input a string. If you enter Y the program will New. Anything else will mean that key press is ignored. Enter the New after the Rem by typing a colon, followed by the New then deleting the colon.

Finally Rem 4 allows you to type in quantities of data far quicker. It makes the space key act as a comma, avoiding the need for using the shift key.

```
  10 DATA 255,243,229,213,197,24
5,205,107,1694
  11 DATA 126,241,193,209,225,25
1,201,253,1699
  12 DATA 203,1,110,200,33,0,0,5
7,604
  13 DATA 235,237,123,61,92,225,
1,127,1101
  14 DATA 16,167,237,56,235,249,
192,42,1204
  15 DATA 83,92,24,2,235,9,35,35
,515
  16 DATA 78,35,70,35,84,93,126,
254,775
  17 DATA 234,192,35,58,8,92,190
,32,841
  18 DATA 235,35,126,254,58,32,2
29,35,1004
  19 DATA 126,254,13,40,223,11,1
1,11,689
  20 DATA 11,197,229,42,91,92,20
5,85,952
  21 DATA 22,19,237,83,91,92,35,
235,814
  22 DATA 225,193,237,176,235,43
,126,254,1489
  23 DATA 35,40,8,205,29,17,253,
203,790
  24 DATA 1,174,201,1,1,0,205,23
2,815
  25 DATA 25,62,13,50,8,92,253,2
03,706
  26 DATA 1,238,201,62,40,237,71
,237,1087
  27 DATA 94,201,62,62,237,71,23
7,86,1050
  28 DATA 201,0,0,0,0,0,0,0,201
 100 LET a=32348: IF PEEK 23732+
256*PEEK 23733>32767 THEN LET a=
65129
 105 PRINT "PLEASE WAIT"
 110 RESTORE : FOR f=0 TO 18: LE
T t=0: FOR g=0 TO 7
 120 READ d: POKE a+f*8+g,d: LET
t=t+d
 130 NEXT g: READ d: IF d<>t THE
N PRINT '"ERROR in line ";f+10:
STOP
 140 NEXT f
 150 IF a=65129 THEN POKE 65261,
9: POKE 65136,120: POKE 65137,25
4
 160 PRINT '"PREPARE TO SAVE 'Fu
nc keys''
 170 SAVE "Func keys"CODE a,150
 180 PRINT '"PREPARE TO VERIFY '
Func keys'"
 190 VERIFY "Func keys"CODE a,15
0
 200 PRINT '"ON  : ";a+131'"OFF
: ";a+138
 210 PRINT '"Press any key to NE
W basic prog."
 220 PAUSE 0
 230 CLEAR a-1: NEW
```

Copy function

A Tugwell,
Walton-on-Thames,
Surrey.



USING THE COPY command on the ZX-81 is a simple and effective way of dumping the contents of the screen to the ZX Printer but it does have one drawback — it copies the whole of the screen even though the bottom half or more is blank.

The routine that I wrote to solve this problem is 51 bytes in length and, for a change, is slower than the equivalent Basic. It will also only work with a fully expanded display file.

If listing 1 is entered and Run it will list itself on the printer and the string prompts will appear. If the hex digits in listing 2 are now entered followed by the letter S the program will Poke the routine into the Rem statement at line 1 and then jump to line 200. Listing 2 will be displayed on the screen and copied from there to the printer by the routine.

If you study lines 330 to 380 you will see that the routine will only copy down to the line where the last "printing" has occurred.

If everything has been entered correctly you should finish up with listings 1 and 2 exactly as shown although those with economy in mind should omit lines 10, 20 and 30.

Listing 1

```
   1 REM 000000000000000000000000
00000000000000000000000000000000
000
  10 LPRINT "LISTING 1"
  20 LPRINT
  30 LLIST
  40 LET X=16514
  50 LET Q$=""
  60 IF Q$="" THEN INPUT Q$
  70 IF Q$="S" THEN GOTO 200
  80 POKE X,16*CODE Q$+CODE Q$(2
)-476
  90 IF PEEK 16442<=2 THEN SCROL
L
 100 PRINT X;" ";Q$( TO 2)
 110 LET Q$=Q$(3 TO )
 120 LET X=X+1
 130 GOTO 60
 200 CLS
 210 FOR N=16514 TO 16564 STEP 8
 220 PRINT N;":";
 230 FOR O=0 TO 7
 240 LET Q=PEEK (N+O)
 250 LET H=INT (Q/16)
 260 LET L=Q-16*H
 270 LET Q$=CHR$ (H+28)+CHR$ (L+
28)
 280 PRINT " ";Q$;
```

(continued on page 191)

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(continued from page 188)

```
290 IF N+O=16564 THEN GOTO 330
300 NEXT O
310 PRINT
320 NEXT N
330 LPRINT
340 LPRINT "LISTING 2"
350 LPRINT
360 RAND USR 16514
370 LPRINT
380 LPRINT "PROGRAMME FINISHED"
390 STOP
```

Listing 2.

```
16514: 2A 0E 40 ED 5B 0C 40 2B
16522: A7 ED 52 C0 11 21 00 65
16530: 01 ED 52 28 04 04 30 F9
16538: 05 2A 0C 40 FD CB 01 CE
16546: E5 23 7E D7 3E 75 3C BE
16554: 20 F7 E1 19 10 F2 FD C5
16562: 01 0E C9
```

Transform

W Lythgoe,
Shevington,
Wigan.



THIS PROGRAM TRANSFORMS drawings up to 50 by 50 pixels in size when they are expressed in Plot and Draw statements. Two examples are given and then you can Input your own drawing.

First draw the diagram on 50 by 50 graph paper and write it out in Plot and Draw statements. Count the number of Draw statements and Enter this. The Enter the co-ordinates as required.

To add your drawing to the data statements change line 110 to:

For m = 1 TO 4

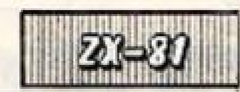
and add a new data line, following the Rem instructions in line 4990.

Further data lines can be added, increasing the final number in line 110 by 1 for each diagram.

```
  10 REM transform
  20 REM W. Lythgoe
 110 FOR m=1 TO 3
 120 IF m<>3 THEN GO SUB 500
 130 IF m=3 THEN GO SUB 1000
 135 DIM c(j+1): DIM d(j+1)
 140 FOR n=1 TO 33
 175 FOR i=1 TO j+1
 180 LET c(i)=0: LET d(i)=0
 185 NEXT i
 187 INK RND*4
 188 GO SUB 2000+10*n
 190 FOR i=1 TO j+1
 200 IF i=1 THEN PLOT a+x(i)*p,b
+y(i)*q
 210 IF i>1 THEN DRAW c(i)+x(i)*
p,d(i)+y(i)*q
 220 NEXT i
 250 BEEP .5,n-12
 255 CLS
 260 NEXT n
 270 NEXT m
 280 STOP
 500 READ j
 510 DIM x(j+1)
 520 DIM y(j+1)
 530 FOR i=1 TO j+1
 540 READ x(i): READ y(i)
 550 NEXT i
 560 RETURN
1000 INPUT "How many DRAWs?";j
1010 DIM x(j+1)
1020 DIM y(j+1)
1030 FOR i=1 TO j+1
1040 IF i=1 THEN INPUT "PLOT x c
o-ord?";x(i): INPUT "PLOT y co-o
rd?";y(i)
1050 IF i>1 THEN INPUT "DRAW x c
o-ord?";x(i): INPUT "DRAW y co-o
rd?";y(i)
1060 NEXT i
1070 RETURN
2010 PRINT "TRANSLATIONS": PAUSE
 200: LET a=0: LET b=0: LET p=1:
 LET q=1:
2015 RETURN
2020 LET a=50: RETURN
2030 LET a=0: LET b=50: RETURN
2040 LET a=50: RETURN
2050 LET a=100: LET b=0: RETURN
2060 LET b=100: RETURN
2070 LET a=0: RETURN
2080 PRINT "REFLECTIONS": PAUSE
200: LET b=0: RETURN
2090 LET a=100: LET p=-1: RETURN
2100 LET p=1: RETURN
2110 LET a=100: LET b=100: LET q
=-1: RETURN
2120 LET q=1: RETURN
2130 LET p=-1: RETURN
2140 LET a=0: LET p=1: RETURN
2150 LET q=-1: RETURN
2160 PRINT "ROTATIONS THROUGH 90
 DEGREES": PAUSE 200: LET q=1: L
ET b=0: RETURN
2170 LET p=-1: LET q=1: GO SUB 3
000: LET a=a+50: RETURN
2180 LET q=-1: LET a=50: LET b=5
0: RETURN
2190 LET p=1: GO SUB 3000: LET b
=b+50: RETURN
2200 PRINT "ENLARGEMENTS": PAUSE
 200: LET a=0: LET b=0: LET p=1:
 LET q=1: RETURN
2210 LET p=2: RETURN
2220 LET p=3: RETURN
2230 LET p=1: LET q=2: RETURN
2240 LET q=3: RETURN
2250 LET p=2: LET q=2: RETURN
2260 LET p=3: LET q=3: RETURN
2270 PRINT "DISTORTIONS": PAUSE
200: LET a=0: LET b=0: LET p=1:
LET q=1: RETURN
2280 GO SUB 3100: RETURN
2290 LET q=2: GO SUB 3100: RETUR
N
2300 LET q=3: GO SUB 3100: RETUR
N
2310 LET p=2: GO SUB 3100: RETUR
N
2320 LET p=3: GO SUB 3100: RETUR
N
2330 LET p=1: LET q=1: RETURN
3000 FOR i=1 TO j+1
3005 LET a=p*(y(1)-x(1))
3010 LET c(i)=p*(y(i)-x(i))
3015 LET b=q*(x(1)-y(1))
3020 LET d(i)=q*(x(i)-y(i))
3030 NEXT i
3040 RETURN
3100 FOR i=1 TO j+1
3110 LET c(i)=p*.5*(y(i)-x(i))
3120 NEXT i
3130 RETURN
4990 REM First no. in each DATA
line is no. of DRAWs. 2nd and
3rd nos. are PLOT co-ords.
Subsequent nos. are DRAW co-ords
5000 DATA 3,0,0,50,0,0,50,-50,-5
0
5010 DATA 32,15,0,5,1,2,1,9,0,5,
2,4,4,0,6,-2,3,-3,0,2,-7,-5,-5,-
7,-2,5,4,1,5,-1,6,-3,5,-3,4,2,3,
0,5,-2,3,-2,10,-4,-10,-2,0,-3,10
,-3,-10,-2,-5,0,-4,2,-3,-4,-7,-1
,-9,1,-6,5,-3,6,-1
```

Character definer

Mazen Kisawi,
North Ahmadi,
Kuwait.



THIS PROGRAM enables ZX-81 users to define their own characters, using a ZX Printer. Before entering the program type New and

POKE 16389,124

Now type in the program and run it.

In the top left-hand corner of the screen line 1 will be reprinted, and the program then waits for an input. The character will be defined on an eight-by-eight grid.

Whenever you want a dot on the first line, enter a full stop. Whenever you want a blank, input a space. This continues for eight lines, working horizontally.

After the character has been defined you can either move on to another character or type in Plot. After that there will be a short pause before the character is printed on the printer. To save any character use the string-saving method. A character is defined between B$ (1) and B$ (8).

```
   1 IF PEEK 16388+256*PEEK 1638
9=31744 THEN GOTO 5
   2 POKE 16384,21
   5 FOR I=0 TO 112
   6 POKE 31744+I,PEEK (2161+I)
   7 NEXT I
   8 POKE 31800,63
   9 POKE 31857,201
  12 DIM A$(32,9)
  15 FOR N=1 TO 32
  20 FOR A=1 TO 8
  25 LET C=0
  30 PRINT AT 0,0;"LINE ";A
  40 INPUT B$
  41 PRINT AT A+1,0;B$
  42 IF B$="PLOT" THEN GOTO 9988
  43 IF LEN B$<8 THEN LET B$=B$+
"
  44 IF B$( TO 4)="EXIT" THEN PO
KE 16384,13
  50 IF B$(1)="." THEN LET C=C+2
**7
  60 IF B$(2)="." THEN LET C=C+2
**6
  70 IF B$(3)="." THEN LET C=C+2
**5
  80 IF B$(4)="." THEN LET C=C+2
**4
  90 IF B$(5)="." THEN LET C=C+2
**3
 100 IF B$(6)="." THEN LET C=C+2
**2
 110 IF B$(7)="." THEN LET C=C+2
 120 IF B$(8)="." THEN LET C=C+1
 130 LET A$(N,A+1)=CHR$ C
 135 PRINT AT 21,0;C
 140 NEXT A
 145 CLS
 150 NEXT N
9990 FOR J=1 TO 32
9991 FOR K=1 TO 8
9992 POKE 32255+K+8*(J-1),CODE A
$(J,K+1)
9993 NEXT K
9994 NEXT J
9995 FOR H=0 TO 31
9996 POKE 16444+H,H
9997 NEXT H
9998 LET HPRINT=USR 31744
9999 POKE 16384,25
```

MEMOTECH *Competition* RESULTS

Unlike most of our competitions, February's contained an extremely tough puzzle. It succeeded in weeding out all but a handful of entries — six to be precise.

The problem was that if you started out by assuming that all six black bricks may be salvaged you were bound to fail. There are 2,900,000 permutations of movement order and direction on this assumption; and none of them work.

In fact the maximum number of bricks you can set free is four. And the minimum number of bricks you can destroy on the way is 36, including two black bricks. The correct order of movement and direction is as follows:

1. Brick 6 to the south-east
2. Brick 4 to the north-west
3. Brick 3 to the north-east
4. Brick 2 to the north-west
5. Brick 1 to the south-east

It does not matter how the brick with five dots moves since brick 6 collides with it. Both are consequently destroyed.

Two of the six correct entries mentioned that they had used a computer to solve the puzzle. If the others did not rely on a program solution they must have been blessed with either luck or inspiration.

I. Llewellen-Jones, 2A Elmbridge Road, Gloucester, GL2 0NZ programmed a Spectrum to crack the puzzle. It ran for 10 hours before coming up with the solution. He complains that this marathon created all sorts of thermal stresses and strains to the machine and himself.

He should be mollified to learn that his tie-breaker wins him the prize of a Memotech MTX 500. The opening sentence read "At work and at play a Memotech would make my day". He completed it by adding "with memory galore, sixteen colours and more, what a splendid give away".

The other program solution came from Yugoslavia. Jovan Puzovic also used a Spectrum which again took 10 hours over it. His tie-breaker read simply, "joyful and gay".

Most contenders struck a similar poetic note. From D. Stanford came "with many problems soon made light by solving puzzles through the night"; A. Grant suggested "its styling is striking, its memory inviting, please I want one today", and K. Cross offered "it's the best, it's clear every day of the year".

Others deserving of a mention were J. Middleton's "with features unique and design so sleek" and R. Pendall's "for accounting or counting, it's money well spent".



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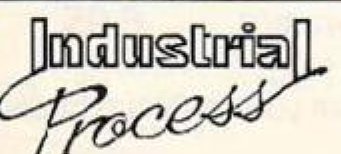
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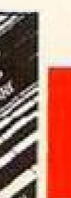
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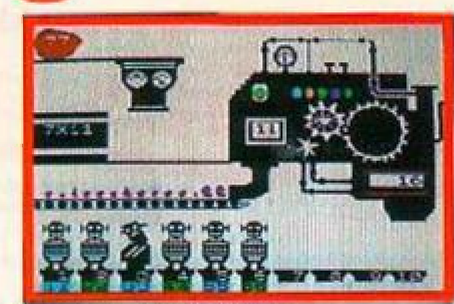
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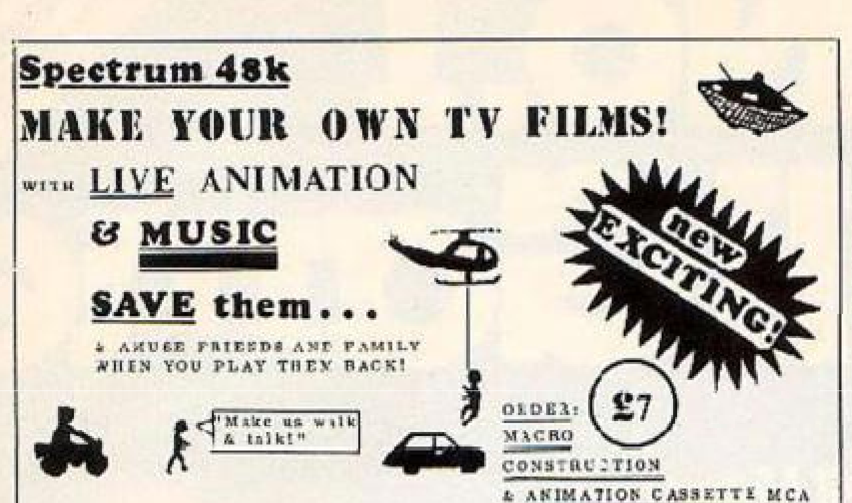
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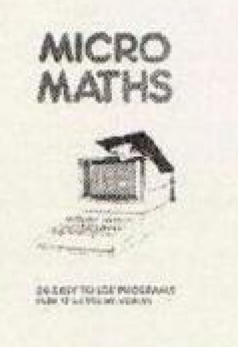
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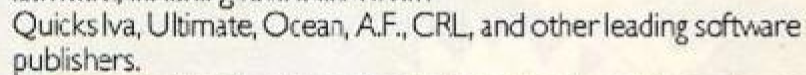
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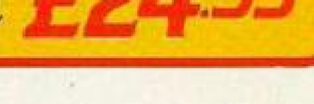
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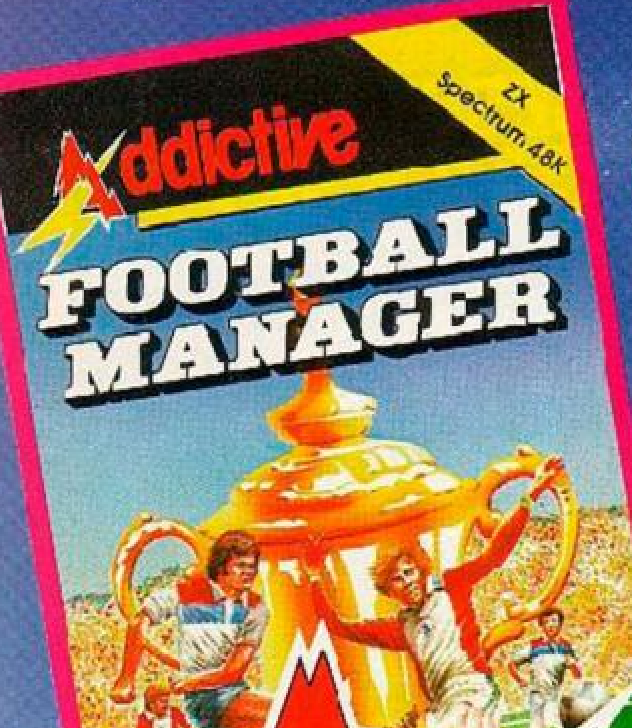




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*ZX81 Chart, Home Computing Weekly 16.8.83



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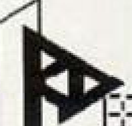
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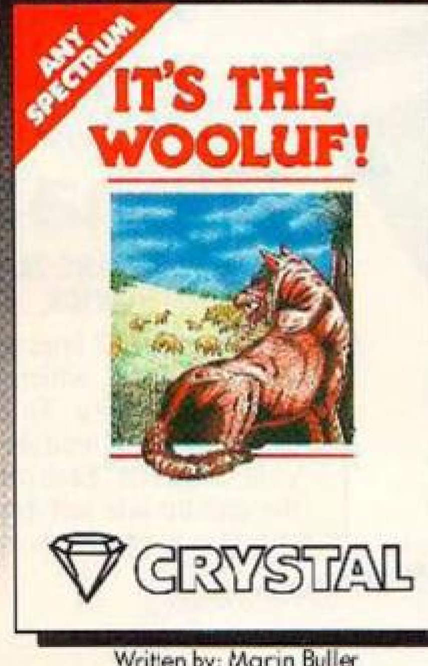
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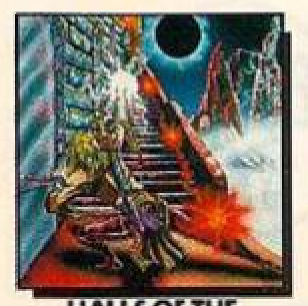




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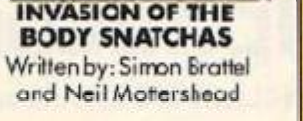
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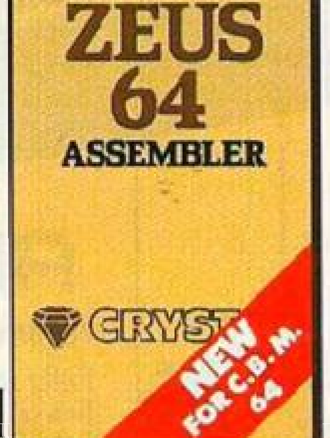


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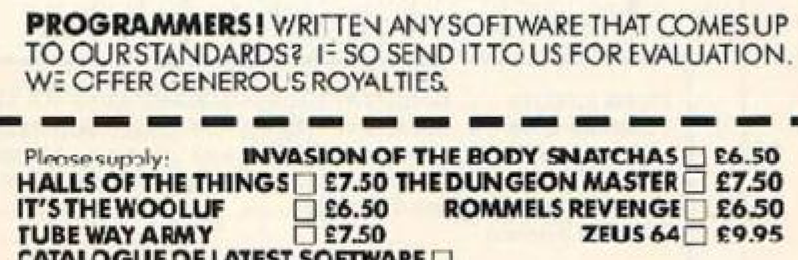


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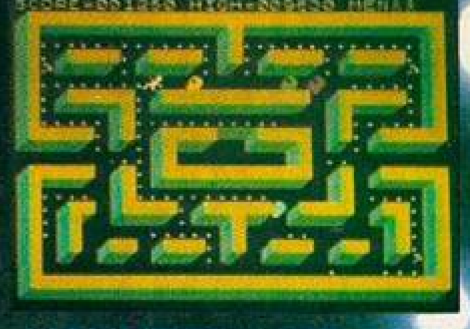
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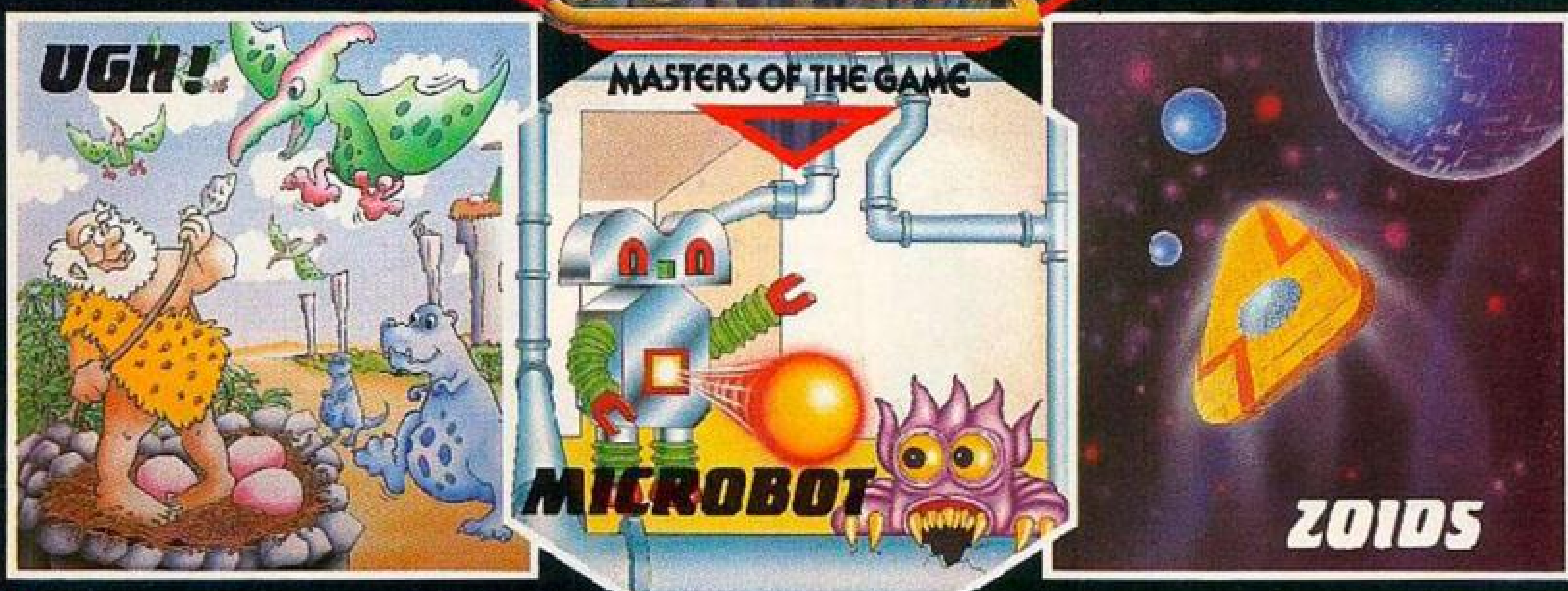
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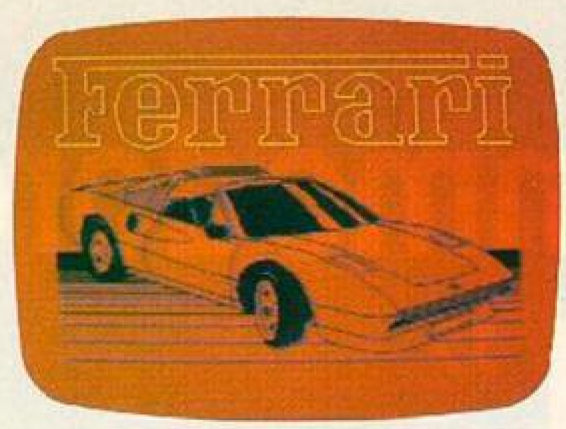
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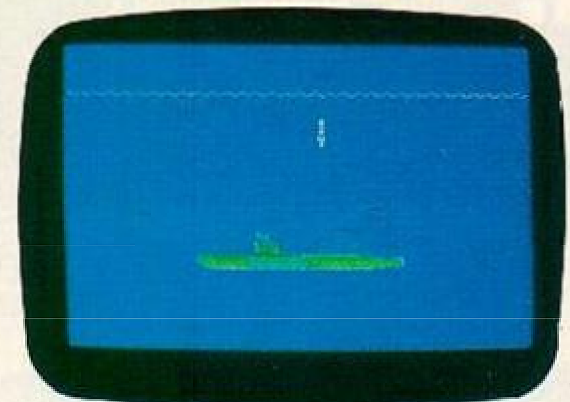
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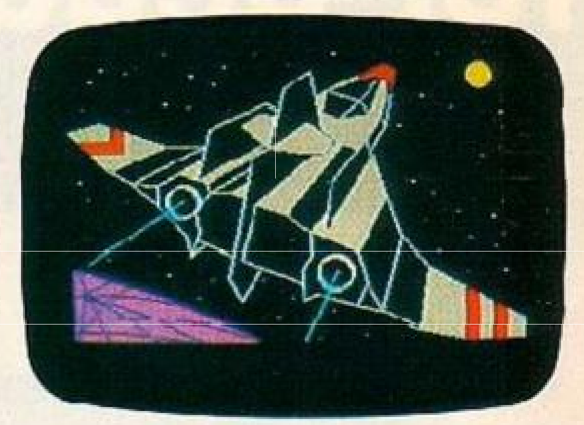




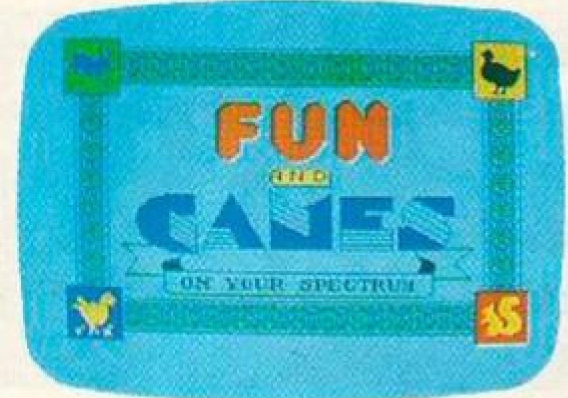














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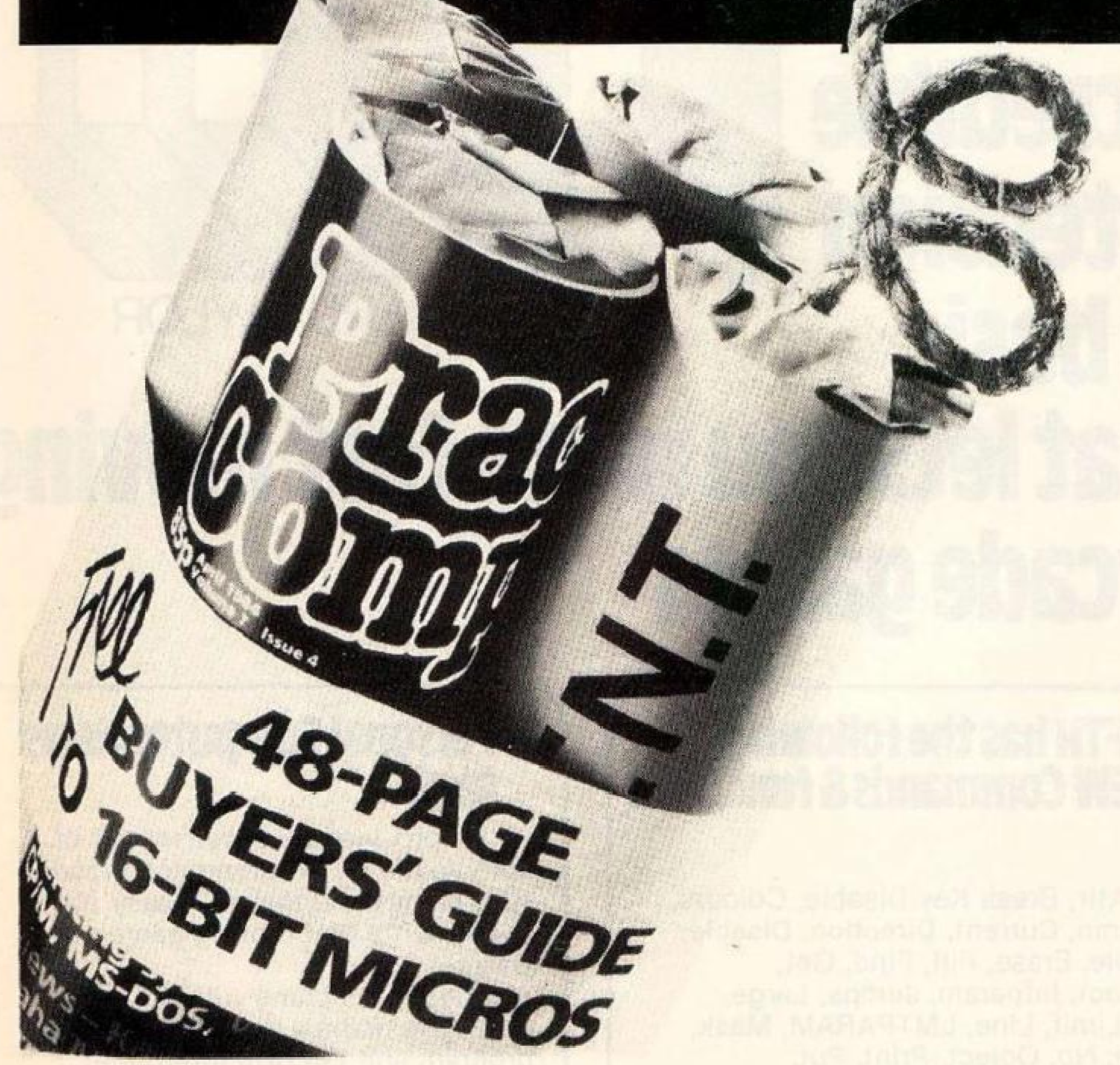
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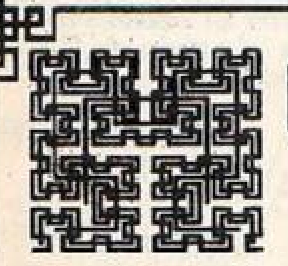


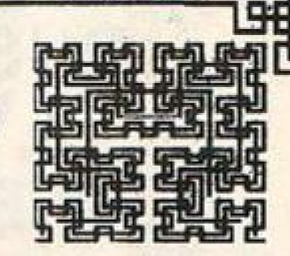
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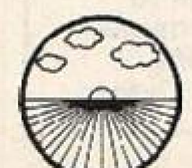
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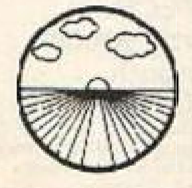
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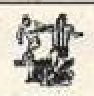
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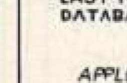
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